

■ POWER QUALITY MONITOR


C.A 8352



ENGLISH

User's manual

 **CHAUVIN
ARNOUX**

Meaning of symbol: 

WARNING! Consult the user's manual before using the instrument.

In this user's manual, instructions preceded by this symbol, if they are not carried out as shown, can result in a physical accident or damage installations.

Thank you for purchasing a C.A 8352 Power Quality Monitor.

To get the best service from this instrument:

- read carefully this user's manual,
- respect the safety precautions.

SAFETY PRECAUTIONS

- It is essential to avoid all possible obstruction of the ventilation grills situated on the left side of the monitor.
- Respect the environmental conditions for use.
- Respect the value and type of fuse or risk damaging the instrument and rendering the warranty void.
- This instrument may be used on category III installations, for voltages not exceeding 500 V in relation to the earth for the current measurement inputs, 1000 V in relation to the earth for the Amp FLEX flexible sensor inputs and 600 V in relation to the earth for the voltage measurement inputs (as per IEC 664-1 Ed. 92).
- Category III equipment is fixed installation equipment, where reliability and availability of the equipment are subject to particular specifications.
- Make sure to only use accessories of overvoltage category and voltage rating at least equal to those of the product.
- Connect or disconnect USB devices only when system is completely initialised.

WARRANTY

Our warranty is applicable, except for expressed stipulation otherwise, for twelve months after the date on which the equipment is made available (extract from our General Conditions of Sale, available on request).

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1st Part
The Power Quality Monitor

1 Introduction

The C.A 8352 Power Quality Monitor is a self-contained instrument in a hard case with lid, operating on AC networks to enable the following parameters to be measured:

Analysis parameters according to EN 50160 standard in effect

- Network frequency
- Supply voltage
- Fast and slow voltage variations
- Short and long interruptions in supply
- Voltage dips and asymmetries
- Harmonic and interharmonic voltages
- Temporary voltage swells at 50 Hz

Flicker analysis

- Flicker analysis as per EN 61000-3 and EN 61000-4-15: short-term (Pst) and long-term (Plt) flicker

Voltage and current analysis

- TRMS and average values
- Peak value and crest factor

Power analysis

- Generated and consumed active power
- Inductive and capacitive reactive power
- Apparent power, power factor, $\cos \varphi$
- Calculation of energies on each phase

Harmonics break-down up to 50th order

- Harmonics: current, voltage, active and reactive power in relation to the fundamental and in absolute
- Phase shift for each harmonic
- THD: overall and order by order
- Direction recognition for each harmonic order
- Interharmonics spectral analysis

Unbalance and system symmetry analysis

- System symmetry measurement: positive, negative and zero sequence components
- Phase shifting
- Absolute value of voltage and current for the complete spectrum
- Fresnel diagram representation in 3U and 3I
- Overall unbalance of three-phase network

HV network analysis (high voltage)

- Records “short-circuit” events (faultograph function)
- Remote control signal analysis: definition and verification of the frame

Using the instrument is self-explanatory, thanks to a Windows® operating system and an LCD “touch screen”, further aided with:

- simultaneously available functions, for improved display
- data storage in internal memory (up to 6 months recording capacity),
- open and easy-to-use file structure,
- aptitude to monitoring and connection to networks,
- writing of protocols and the creation of test reports,
- data processing and report publishing software,
- real-time synchronisation via an external clock input (optional).

2 Presentation

2.1 Overview of the unit

- Colour LCD touch screen
- USB interface connectors enabling the connection of USB: mouse, screen, back-up memory, modem, printer...
- Voltage inputs: U_{L1} , U_{L2} , U_{L3} and U_N : 8 safety terminals, marked in black and blue
- Current inputs: I_{L1} , I_{L2} , I_{L3} and I_N : 4 input connectors for current clamp use (clamp C, Amp FLEX...) (refer to connector-pin diagrams)
- Mains supply connector with incorporated fuse

On the LH side at the back of the unit are the ventilation grills, designed to cool the instrument. It is essential that these ventilation holes remain unobstructed. The ventilator openings should be kept open to avoid overheating.

2.2 Screen

The colour LCD touch screen enables the instrument to be used without an external keyboard or mouse. Simply touch on the part of the menu screen of interest with your index finger, or other pointed object that does not risk damaging or scratching the screen.

The different menus displayed enable:

- setting of the different parameters,
- display of measurements in different forms,
- data analysis and printing,
- transfer of data to a back-up memory or another computer.

3 Setting-up

The instrument runs an operating system based on Windows®98.

Connect the instrument to the electrical mains network using connector A, the Power Quality Monitor takes an 85 to 265 V~ mains supply input that does not require switching. Turn the instrument ON.

4 Specifications

4.1 C.A 835 2 specifications

4.1.1 Electrical specifications

■ Reference conditions

- Temperature: 25°C
- Relative humidity: 50% RH

■ Voltage measurement inputs

- Measurement range :
 - Phases L1, L2, L3 : 4 programmable ranges: 70, 150, 300 and 700 VAC
 - Neutral : 4 programmable measurement ranges: 5, 10, 50 and 100 VAC
- Bandwidth: 10 Hz to 50 kHz
- Accuracy: < 0.5 %
- Input impedance: 1 MW, 5 pF
- Input divider: 1:1000 (1:100 Neutral)
- Type of inputs: 1 phase, 3 phase, 3 phase + N, delta connection, star connection,
- Transient response: 10 kV/μs

■ Current measurement input

- Measurement range: 0,05 A to 5 A programmable on phases L1, L2, L3 and the neutral

Current range	0,05...0,5 A	0,5 A...5 A
Accuracy	$\leq 2\%$	$\leq 1\%$
Phase shift	$\leq 0,2^\circ$	$\leq 0,2^\circ$

- Bandwidth: 10 kHz to 25 kHz
- Max. current: 20 A continuous, 500 A at 1 ms
- Accuracy: $< 1\%$
- Phase shift: 0.2°
- Input impedance: $< 2.5\text{ m}\Omega$
- Input inductance: $< 1.5\text{ }\mu\text{H}$
- Temperature drift: $0.08\% / ^\circ\text{K}$
- Insulation voltage: 2.5 kV rms, 50 Hz, 1 min
- Transient response: $> 50\text{ A} / \mu\text{s}$

■ **Frequency:** 47 to 63 Hz $\pm 0.01\text{ Hz}$

■ **Power:** $\leq 2\%$ active, reactive, and apparent

■ **THD-U:** $< 1\%$

- THD-I: $< 1\%$
- PF: $< 1\%$

△ With triangle connection, only the global powers are significant

■ System specifications

- A/D converter: 12 bits
- Sampling rate: 6.4 kS/s to 25.6 kS/s with anti-aliasing filter (3 kHz, 80 dB)
- autoscanning, synchronisation to 50 Hz
- Display: 7.5" (19.05 cm) color liquid crystal touch screen
- User interface: Touch screen
- Other interfaces: 1 USB port, 10 Mbit transfer rate, 30 V cat III

■ Data storage intervals

- Start / Stop : manual, external command or calendar
- Measurement rate: 160 ms, k * 160 ms, 3 s, 1 min, 10 min, 15 min, 60 min
- Recording time: function of the storing interval (1 week to 3 years)
- Hard disk: 10 Gbytes
- Data storage intervals for the min / max / average values: 160 ms, k * 160 ms, 3 s, 1 min, 10 min, 15 min, k * 1 min
- Recording length: 1 week to 3 years (for 3 s to 10 min intervals)

■ Power supply

- Mains supply: 90 to 260 VAC (47 to 63 Hz) without switching (see § 3)
- Consumption: 35 VA typ.

4.1.2 Mechanical specifications

- **Vibrations** : MIL-STD 810C 514.2 Procedure X
- **Index of protection** : IP 43
- **Shocks** : MIL-STD 810C

4.1.3 Construction specifications

- **Dimensions** : 36 x 30 x 15 cm
- **Weight**: 4 kg approx.

4.1.4 Climatic conditions

- **Operating temperature**: -10 to +50°C
- **Storage temperature**: -30 to +70°C
- **Humidity**: 10 to 90 % RH without condensation

4.1.5 Conformity with international standards

Electrical safety (as per EN 61010-1)

- **Pollution level**: 2
- **Installation category**: III
- **Max voltage in relation to earth**:
 - Voltage measurement inputs: 500 V
 - Current measurement inputs: 500 V
 - Current measurement inputs for flexible Amp FLEX sensors: 1000 V

Electromagnetic compatibility

- **Emission**: NF EN 50 081 -1 (Ed 92)
- **Immunity**: NF EN 50 082 -1 (Ed 95)

Analysis procedures

EN 50160 (Ed 98)
IEC 61000-4-15

4.2 Input specification

Voltage inputs:	4 channels up to 2 kVpp
Current inputs:	4 channels, range depends on sensors used: MN 95: 0.2 to 6 A C145 clamp: 2 to 1200 A AmpFLEX A195: 25 to 3000 A Accuracy: < 1%
Analogue inputs:	Up to 16 channels, max.1 Hz (optional) For recording environmental conditions, depending on the application

Binary input: 1 external 24 Vdc channel
for recording start-up
With transient option: 1 binary output, dry contact,
100 V max (for “transient triggering” status)
1 external 24 Vdc binary input
(for “transient triggering” mode start-up)

4.3 Main system

Main processor: 256 Mbyte RAM for recording start-up
Working memory: 10 Gbytes
Display: 10" LCD color screen
User interface: touch screen
Equipment interface: 1 USB port for keyboard,
2 x RS232 ports: data logger (optional),
printer, binary I/O
Sampling rate: 9.6 kHz/channel maximum
(38.4 kHz in transient mode, be it 25 µs)

4.4 General specifications

Analysis standards met: EN 50160
EN 61000-2, -3, -4
EN 61000-4-15
EN 61000-4-30
Electrical safety: IEC 61010-1, 500 V,
category III pollution degree 2

4.5 Environmental conditions

Operating temperature: -10°C to +50°C
Storage temperature: -20°C to +70°C
Relative humidity: 10% to 90% (with no condensation)
Dimensions: 360 x 300 x 150 mm
Weight: 4 kg
Supply voltage: 85 to 135 VAC and 180 to 265 VAC

4.6 Communications

Via modem as per publication: CCITT V90 56 kbds
Via Ethernet

5 Specifications for sensor and pad

5.1 Specification of the Amp Flex A195 with C.A 8352 (accessories)

5.1.1 Electrical data

- Nominal range: 3000 A AC
- Measurement range: 25 A to 3000 A AC
- Input/Output ratio: 140 mV AC/3000 A AC at 50 Hz

Note: the output is proportional to the amplitude and the frequency of the current measured.

- EN 61010-1 and 2 (electrical safety) 1000 V, CAT III, POLL 2

5.1.2 Reference conditions

Temperature	18°C to 28°C
Humidity	20% to 75% of RH
Position of conductor for measurement	centred within the air-core
Continuous magnetic field	< 40 A/m (earth's magnetic field)
External alternative magnetic field	none present
External electric field	none present
Frequency from	10 Hz to 100 Hz
Type of signal measured	sinusoidal

- Error in the reference conditions

Primary current (in A AC)	25 A...3000 A
Accuracy (as % of the output signal)	≤ 1%
Phase shift at 50 Hz (in °)	≤ 1°

- Influence of adjacent conductor :
 - ≤ 1% of interference current at 50 Hz (≤ 2% near catch)
- Influence of conductor position in the loop : ≤ 1% (≤ 4% near catch)
- Influence of sensor shape : ≤ 1% for an oblong shape

5.1.3 Climatic conditions

- Working temperature :
 - 10° to +55°C, (maximum temperature for sensor is 90°C)
- Storage temperature : -40° to +70°C
- Temperature influence : ≤ 0.5% of output signal per 10 K
- Operating humidity :
 - from 0 to 95% of RH with linear decrease beyond 35°C
- Influence of humidity :

< 0.2% of output signal from 10% to 85% of RH

- Non operating altitude : 0...12000 m

5.1.4 Mechanical specifications

- Casing protection :
Flexible sensor : IP65 (IEC 529)
- Dimensions :
Case : 140 x 64 x 28 mm
Connector lead : 2 m (connects sensor to case)
Flexible sensor : Ø 12 mm ±0.5 mm (450 mm)
Ø 20 mm ±0.5 mm (800 mm)
- Weight :
Flexible sensor : approx. 30 g per 10 cm length


5.2 Specification of the clamps C 145

5.2.1 Reference conditions

- Conductor centred inside jaws
- Temperature : 20...26°C, see diagram
- Relative humidity : 20...75% RH, see diagram
- Sinusoidal current : frequency 48...65 Hz
- Distortion factor : < 1%
- Continuous magnetic field: Earth's magnetic field (40 A/m)
- Alternating magnetic field: none present
- Proximity of external conductors: no direct or alternating current
- Intrinsic error or phase displacement

AC current to be measured	2...200 A	200...1000 A
Intrinsic error	≤ 1%	≤ 1%
Phase displacement	≤ 1.5°	≤ 1°

5.2.2 Conditions of use and affecting factors

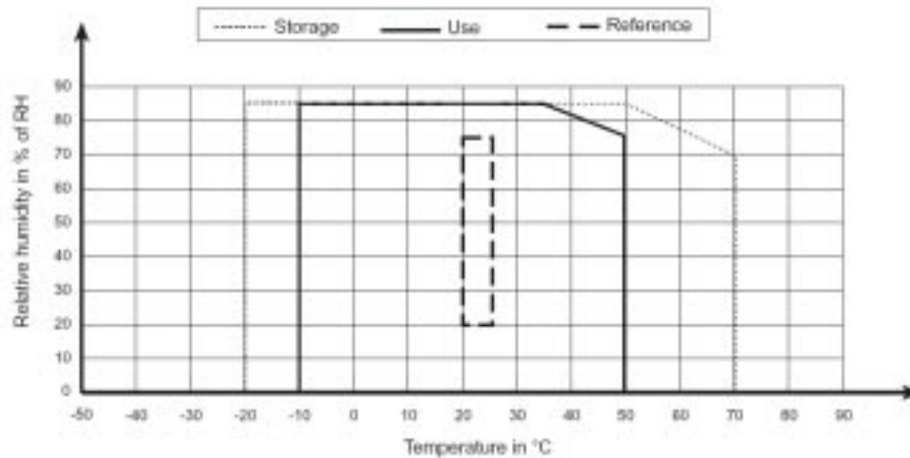
 The clamp must be used within the following parameters to ensure user safety and measurement accuracy.

5.2.3 Measurement parameters

- Measurement range : 2...1200 A ~
- Output/input ratio : 1000 A / 5 A
- Frequency range : 30...5000 Hz
- Normal current : 1000 A ~

5.2.4 Environmental parameters

- Climatic conditions
- Transport altitude: ≤ 12000 m



5.2.5 Effect of frequency variation

Values to be added to those in *References Conditions*

Frequency	30...48 Hz	65...1000 Hz	1 kHz...5 kHz
Measurement error	< 1% I _{output}	< 0.5% I _{output}	< 1% I _{output}

5.2.6 Effect of peak factor

- Effect on measurement: < 1% I_{output}, for peak factor ≤ 6 and $I \leq 3000$ A_{peak}

5.2.7 Effect of load

- Effect of load (0.2...0.6 Ω): < 0.5% on measurement
< 0.5° on phase

5.2.8 Effect of temperature variation

- < 0.1% of I_{output}/10°C, from -10°C to +50°C

5.2.9 Overloading

Restrict usage time above 1000 A ~

- For frequencies ≤ 1 kHz

Current I	≤ 1000 A ~	1000 A ~ < I < 1200 A ~
Operation	Continuous	< 30 min in use

		> 15 min break
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- For frequencies > 1 kHz
Frequency derating above 1 kHz, following the formula :
Continuous maximum I (A) = $\frac{1000}{f \text{ (in kHz)}}$

5.2.10 Mechanical specifications

- Dimensions: 216 x 111 x 45 mm
- Weight: 550 g
- Maximum jaw opening: 53 mm (patented opening system)
- Clamping capacity:
 - Cable: Ø max 52 mm
 - Busbar: 1 busbar of 50 x 5 mm / 4 busbars of 30 x 5 mm

5.2.11 Compliance with international standards

Electrical safety

As per NF EN 61010-2-032 -6: 600 V - Cat. III

Electromagnetic compatibility

as per NF EN 61326-1 - industrial environments

5.3 Specification of the clamps MN95

5.3.1 Reference conditions

- Temperature: +20... +26°C
- Humidity: 20... 75% RH
- Conductor centred in jaws
- Sinusoidal current: 48... 65 Hz
- Distortion factor: < 1%
- Direct current: no
- Continuous magnetic field: earth field (< 40 A/m).
- Proximity of external conductors: no current
- Measuring device impedance: > 1 MΩ

5.3.2 Specifications

- Nominal range : 5 A~
- Measurement range : 10 mA...6 A
- Output/input ratio : 1 A~ / 60 mV~

5.3.3 Precision and dephasing

NB : Intrinsic error as % of output signal

Intensity in A~	0.2 to 0,5 A	0.5 to 1 A	1 to 6 A
Intrinsic error	≤ 3 %	≤ 1.5%	≤ 1%

Dephasing	$\leq 1.5\%$	$\leq 1.5^\circ$	$\leq 1^\circ$
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5.3.4 Conditions of use



The miniclamps must be used in the following conditions, in order to comply with user safety and metrological performance requirements.

- Frequency
 - Use : 40 Hz to 10 kHz.
 - When used continuously above 200A, frequency should be limited to 1 KHz.
- Environmental conditions
 - Climatic conditions: -10 to +55° C and RH < 85%

5.3.5 Dimensions and weight

- Overall dimensions : 135 x 50 x 30 mm
- Weight: approx. 180 g
- Jaw opening : 21 mm
- Open jaw height : 69 mm
- Max. clamping capacity : Ø 20 mm cable or 20 x 5 mm busbar.

5.3.6 Compliance with international norms

- Jaws : V0 (as per UL 94)

5.4 Specifications for the analogue inputs for PAD (Programmable Acquisition Data)

- Differential analogue input
- Serial digital output
- RS-485 interface
- Typical consumption: 600 mA

5.4.1 PAD-V8

- 8 differential inputs
- Input ranges: ± 150 mV, ± 500 mV, ± 1 V, ± 5 V, ± 10 V or 20 mA (external shunt)
- Accuracy: < 0.1%
- Resolution: 16 bits
- Sampling frequency: 1/3 Hz
- Overvoltage: ± 35 V
- Insulation voltage: 1000 V DC (non-insulated between inputs)

5.4.2 PAD-VTH8

- 8 differential inputs
- Input ranges: ± 15 mV, ± 50 mV, ± 100 mV, ± 500 mV, ± 1 V, $\pm 2,5$ V or 20 mA (external shunt)
- Thermocouples:

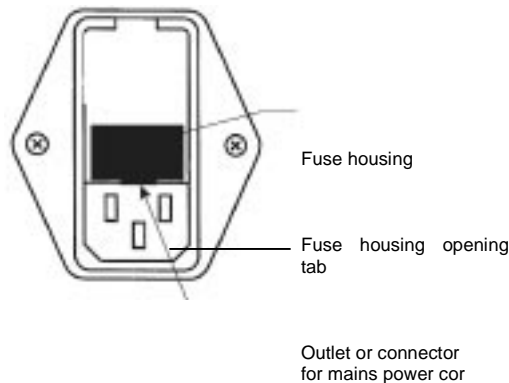
"J" : 0 to 760°C	"K" : -50°C to 1300°C
"T" : -100°C to 400°C	"E" : 0°C to 1000°C
"R" and "S" : 500°C to 1750°C	B" : 500°C to 1800°C
"N" : -270°C to 1300°C	"C" : 0°C to 3320°C
- Accuracy: $< 0.1\%$
- Resolution: 16 bits
- Sampling frequency: 1/3 Hz
- Overvoltage: ± 35 V
- Insulation voltage: 1000 V DC (non-insulated between inputs)

6 Maintenance

For maintenance of the instrument, only use the spare parts that have been specified. The manufacturer cannot be held responsible for any accident that occurs following repairs made outside of its after-sales service or by anyone other than a certified repairman.

6.1 Replacing the mains fuse

- Disconnect the mains supply lead
- Extract the fuse support found just above the mains connector
- Replace the defective element with a fuse of the same model: Fuse T 3.15 A - 250 V - 5 x 20 mm



6.2 Cleaning the instrument's casing

- Clean the casing with a cloth lightly dampened in soapy water.
- Rinse off with a wet cloth.
- **Do not use solvents.**

6.3 Metrological verification

- It is essential that all measuring instruments are regularly calibrated.
- For checking and calibration of your instrument, please contact our accredited laboratories (list on request) or the Chauvin Arnoux subsidiary or Agent in your country.
- We advise you to check this instrument at least once a year.

6.4 Repairs

Repairs under or out of guarantee: please return the product to your distributor

7 To order

To order the instrument configured to your needs, fill out the boxes in the order form below

Power Quality Monitor: Code

C A 8 3 5 2

Standard instrument includes harmonic analysis,
oscilloscope mode, vector scope, standard model supplied with
carrying bag, 4 current leads (5 A max.), 8 voltage leads,
8 crocodile clips, data processing software CD ROM,
USB cable, plus all options marked in the order form.

Optional functions

Put a 1 to order a function (0 to leave it out)

Power analyzer, RMS hp..... 0 or 1
Flicker meter, Quality analyzer 0 or 1
Transient recorder..... 0 or 1
Data logger 0 or 1
Remote control signals..... 0 or 1
Power 2: symmetry, impedance 0 or 1
Remote drive via modem 0 or 1

Current sensors

Come in a shoulder bag, with 4 current leads (max. 5 A) and 8 voltage leads

None X X
Set of 4 x C145 clamps (1000 A - Ø 52 mm) C X
Set of 4 x AmpFLEX A195 (3000 A - Ø 140 mm / length 450 mm). A 1
Set of 4 x AmpFLEX A195 (3000 A - Ø 250 mm / length 800 mm) A 2
Set of 4 x MN95 clamps (5 A - Ø 20 mm) M 5

User manual languages

French (by default) F R
English G B
German A L
Italian I T
Spanish E S

2P + E mains supply lead

French, German or Spanish (by default) F
English G
Italian I
Swiss C

Accessories

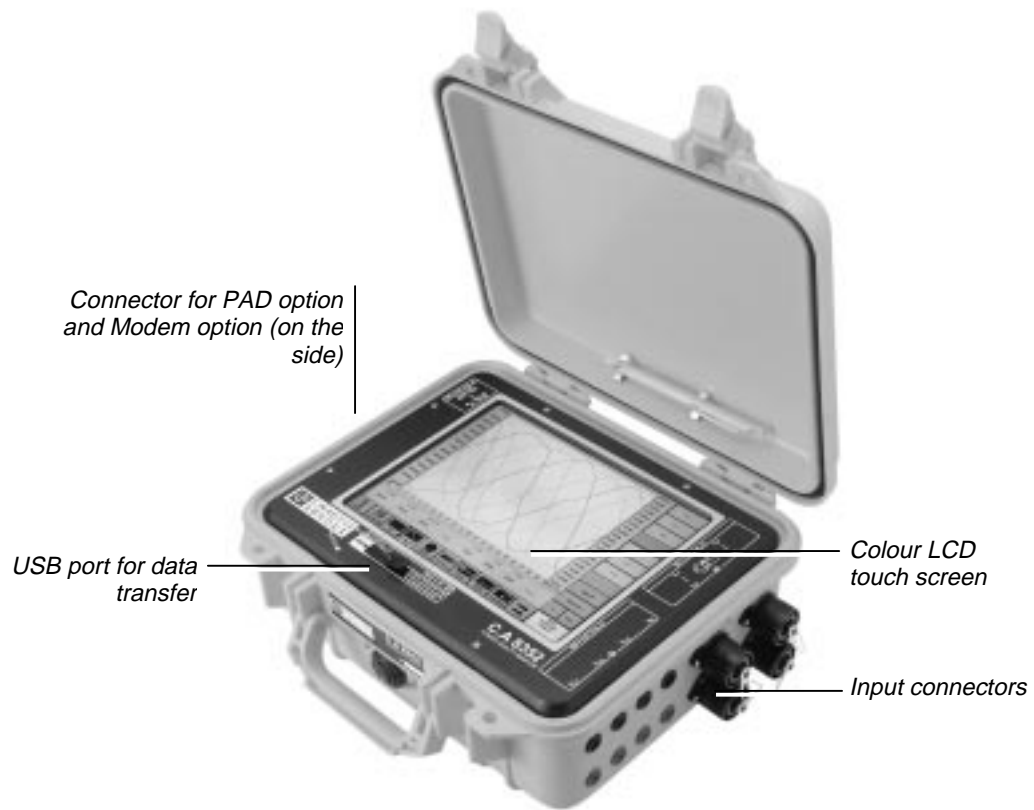
4 current leads (maxi 5 A) P01.2951.84A
4 x C145 clamps (1200 A) P01.1203.19A
8 voltage leads (4 blue, 4 black) P01.2951.83
4 x AmpFLEX A195 800 mm (3000 A) P01.1205.20
4 x AmpFLEX A195 450 mm (3000 A) P01.1205.19
4 x MN95 clamps (5 A) P01.1204.29
1 USB connecting cable P01.2951.85
Carrying bag P01.2980.34

Optional functions to add to those already on your instrument can be ordered. Be sure to include the instrument's serial number in the order form.

OPT							Serial numberr
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8 Appendix

8.1 Controls and connectors

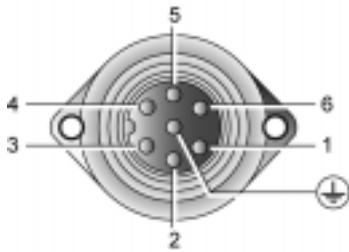


8.2 Input connectors

(see connector pins drawing § 8.3)

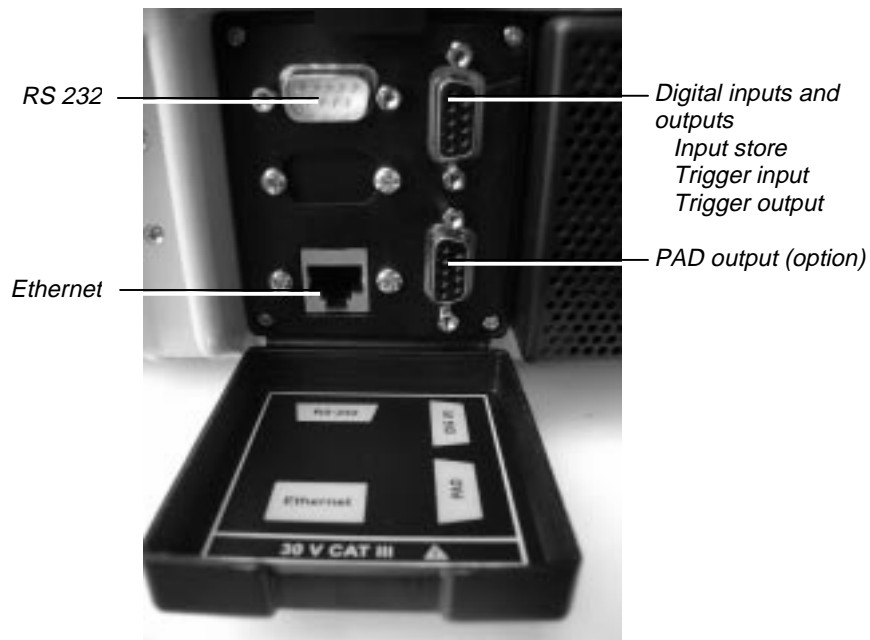


8.3 Connector pins for current measurement



- 1 : (+) Input for current measurement 1 / 5 A
- 2 : (-) Input for current measurement 1 / 5 A
- 3 : (+) Amp FLEX Input
- 4 : (-) Amp FLEX Input
- 5 : Not connected
- 6 : Input (+ V) for MN 95
- : Input (+ V) for MN 95

8.4 Rear connectors



8.5 Accessories



Ampliflex

MN clamp

C clamp

8.6 Mathematical formulas for the calculation of different parameters

Voltage RMS value	$U_{RMS} = U_A = \frac{1}{128} \sqrt{\sum_{n=1}^{128} U_n^2}$
Current RMS value	$I_{RMS} = I_A = \frac{1}{1024} \sqrt{\sum_{n=1}^{1024} I_n^2}$
Mean value of the voltage	$U_{ABC} = \sqrt{\frac{U_A^2 + U_B^2 + U_C^2}{3}}$
Mean value of the current	$I_{ABC} = \frac{1}{3} (I_A + I_B + I_C)$
Apparent power [VA]	$S = U_{RMS} I_{RMS}$
Real power [W]	$P = \frac{1}{1024} \sqrt{\sum_{n=1}^{1024} U_n I_n}$
Power factor [PF]	$PF = \frac{P}{S}$
Reactive power [var]	$Q = \sqrt{S^2 - P^2}$
1st harmonic power [W]	$P_1 = U_1 I_1 \cos(\varphi_{U1} - \varphi_{I1})$
1st harmonic reactive power [var]	$Q_1 = U_1 I_1 \sin(\varphi_{U1} - \varphi_{I1})$
Displacement factor [dPF, cos φ]	$dPF = \cos(\varphi_{U1} - \varphi_{I1})$
Total apparent power [VA]	$P_{ABC} = P_A + P_B + P_C$
Total active power [W]	$S_{ABC} = S_A + S_B + S_C$

Total reactive power [var]	$Q_{ABC} = Q_A + Q_B + Q_C$
Total real power of 1st harmonic [W]	$P_{1ABC} = P_{1A} + P_{1B} + P_{1C}$
Total reactive power of 1st harmonic [var]	$Q_{1ABC} = Q_{1A} + Q_{1B} + Q_{1C}$
Power factor	$PF_{ABC} = \frac{P_{ABC}}{S_{ABC}}$
Power factor given by 1st harmonics	$dPF_{ABC} = \cos \arctg \frac{Q_{1ABC}}{P_{1ABC}}$
Voltage non-symmetry coefficient [%]	$\alpha_u = \sqrt{\frac{A - \sqrt{3A^2 - 6B}}{A + \sqrt{3A^2 - 6B}}}$ <p>where $A = U_A^2 + U_B^2 + U_C^2$</p> <p>and $B = U_A^4 + U_B^4 + U_C^4$</p>
Total voltage harmonic distortion [THD]	$THD_U = \frac{\sqrt{\sum_{n=2}^{50} U_n^2}}{U_1} \cdot 100$
Total current harmonic distortion [THD]	$THD_I = \frac{\sqrt{\sum_{n=2}^{50} I_n^2}}{I_1} \cdot 100$

Then are the values of S, P, Q, Q₁, P₁ integrated in time domain what gives the energy values A_S, A_P, A_Q, A_{Q1}, A_{P1}.

2nd Part The Software

9 Setting procedure before measurement

9.1 Overview of general setup-options (MOP¹)



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¹ **Module-Options-Panel**

9.2 System settings

All basic settings in the [*System*] module, necessary for the desired recording of measurements, are specified by the user.

9.2.1 Settings in the C.A 8352 option System



9.2.1.1 Start-screen

After the start of the C.A 8352 software version 2.x, the following screen appears on the display:

The screenshot shows the 'Option System' start screen of the C.A 8352 software. The interface includes a top header with the 'CHAUVIN ARNOUX' logo and 'License: Demo' and 'Serial Number: Demo' fields. The main area contains several input fields: 'User' (DEMO_USER), 'Project' (DEMO_PROJET1), 'Configuration' (DEFAULT), 'Language' (ENGLISH), 'Connection' (3xUpH + 3xUpH Y/D + M), and 'Instrument Mode' (Simulation). A vertical sidebar on the right contains buttons for 'User Project', 'Configuration', 'Language', 'Setup', 'Options', 'Info', 'Start Here', and 'Quit'. The bottom status bar displays the Chauvin Arnoux logo, version '2.004', and a date/time stamp '15/07/2004 09:40:29'.

Figure 9-1: Option System

Display:

The screenshot shows the CHAUVIN ARNOUX software interface. At the top, there is a logo and the text "CHAUVIN ARNOUX". To the right of the logo, there are two fields: "License:" with the value "Demo" and "Serial Number:" with the value "Demo". Below these fields is a large teal-colored area containing several configuration parameters, each with a label and a corresponding text box:

- User: DEMO_USER
- Project: DEMO_PROJET1
- Configuration: DEFAULT
- Language: ENGLISH
- Connection: 3xUph + 3xIph Y/D + M
- Instrument Mode: Simulation

At the bottom of the interface, there is a footer with the text "© 2004, ChauvinArnoix, C.A.R352" and "Developed in LabVIEW ® National Instruments ®".

In the display area next to the license and serial number, a view of some of the actual parameters is shown.

Note: The denotation "**DEFAULT**" always indicates standard settings (initial values).

Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option [**System**].



Lower button panel:



The lower button panel of the window shows the **Module-Options-Panel**, which permits changing/selection of other options. Upon the start of the C.A 8352 software (at this moment, no measurement has begun) and with terminating a current measurement, all module buttons are displayed gray, with the exception of the standard buttons [**System**] and [**Store**]. Here the option [**System**] is selected (always with the start of the C.A 8352 software) and appears therefore as though it has been pressed.

Note: All buttons² will appear in the activated position, as soon as they are pressed.

Note: Settings for the recording of measurements in the options [**System**] and [**Store**] can be modified only if no recording is taking place at that time.

² Provided that the corresponding module has been licensed.

9.2.1.2 Options and functions in detail



In the module **[System]** all basic settings, which are necessary for the desired recording, are specified by the user.

9.2.1.3 Right button panel: menu buttons and their functions

9.2.1.3.1 Overview

User/Project	... Page 38
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Info	... Page 67
Start Meas	... Page 67
Quit	... Page 67
Post	... Page 68
ST	... Page 68



Pressing the button **[User/Project]** changes the display to the list of the existing user names (listed in the field "UserList") and their project names (listed in the field "ProjectList"). In Figure 9-2, no users or projects are available, therefore only the Term "DEFAULT" is seen (meaning: unnamed user and/or unnamed project).



Figure 9-2: Display after pressing the button **[User/Project]**

Within this field, new user and project names can be added, deleted and/or selected.



By pressing this button, a keyboard screen appears. This allows a **user name** to be entered, e.g.: "demo_user".





By pressing this button, the **user name** marked in the field "UserList" is deleted.



Warning: With this action, projects and measurement data associated with this user name are deleted.



By pressing this button, a keyboard screen appears. This allows a **project name** to be entered,

e.g.: „demo_project1“.



Note:

Since the projects are assigned always to a user name, this must be marked before pressing the button **[Add Project]** in the "UserList".



By pressing this button, all marked **project names** in the field "ProjectList" are deleted.



Warning: With this action, measurement data linked with these project names are also deleted.



By pressing this button, marked **user names** in the field "UserList" and the marked **project names** in the field "ProjectList" are saved, and the display changes into the output window of the module **[System]** with the display of the new values.

Configuration

Pressing the button **[Configuration]** changes the display to the existing configurations listed in the field "configuration list". In Figure 9-3, no configurations exist. Therefore only the "DEFAULT" appears (meaning unnamed configuration).



Figure 9-3: Display after pressing the button **[Configuration]**

In this field, new configurations can be added, and existing ones can be deleted and/or selected.

Note: Under the term **configuration** all set measurement parameters of a measurement can be saved and thus e.g. by repetition of a measurement, it can be resaved.

Add Config

By pressing this button, a keyboard screen appears. This allows a **configuration name** to be entered.

e.g.: „demo_configuration“



Delete Config

By pressing this button, the marked **configuration name** in the field „*Configuration List*“ is deleted.

Back


By pressing this button, marked **user names** in the field "UserList" and the marked **project names** in the field "ProjectList" are selected, and the display changes into the starting window of the module [**System**] with the display of the new values.

Language

Pressing the button [**Language**] changes the display to a listing of all available languages.
In Figure 9-4, only the languages "DEUTSCH", "ENGLISH" and "FRANCAIS" are listed.



Figure 9-4: Display after pressing the button [Language**]**

By marking the desired language and then confirming with the  button, all terms used by the instrument are translated into the marked language. The display changes into the output window of the module [**System**].



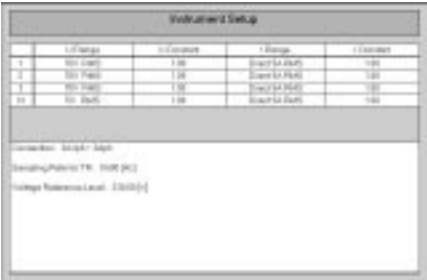
Pressing the button **[Setup]** changes the display to the measurement parameters and the way they were set during the last measurement.



Figure 9-5: Display after pressing the button **[Setup]**

In this field, all measurement parameters (connections, measurement range, current/voltage transformer settings, pre-setting for the modules EN50160, PAD, Transient, Alarm and Telegram) can be set.

The upper area of the display shows a tabular overview of the actual measurement parameters (within this field no settings can be set):



Likewise, the lower area of the display shows actual measurement parameters that are changeable, however, from here:



The **fundamental frequency** is set in this field. This is done by selecting the field and marking the desired value in the displayed list. (Note: Changing this frequency affects the length of the FFT window of the FFT-analysis $T_w = N \cdot f_1$)



In this field, the frequency resolution of the measurement instrument can be set. This is done by selecting the field and marking the desired option from the displayed list:



By activating **harmonics** the analysis is in accordance with IEC61000-4-30 and is in steps (increments) that correspond to the basic frequency, i.e. the value for the n-width unit harmonics corresponds to an averaged value for the frequencies of $n - \frac{f}{2}$ to $n + \frac{f}{2}$. By activating **interharmonics** the analysis is in accordance with IEC61000-4-30 and is in steps (increments) that correspond to half the basic frequency, i.e. the value for the n-width unit harmonics corresponds to an averaged value for the frequencies of $n - \frac{f}{4}$ to $n + \frac{f}{4}$.



By clicking on the window immediately below "Simulate Meas.", a **demonstration measurement** with simulated demonstration data is activated.

Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option [**Setup**].

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Connection

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EM50160

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Telegram

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Ping

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Actual/Value

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Back

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Connection

By pressing this button a screen appears with the connection diagram as it was set at last (here with the example "C.A 8352"):

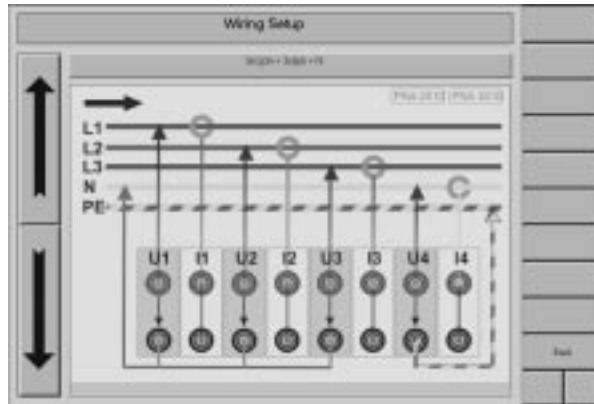

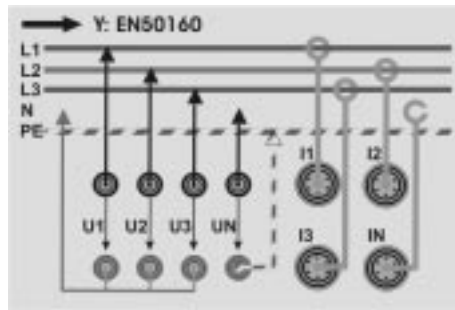


Figure 9-6: Display after pressing the button
[Connection]

All possible connection diagrams can be paged through by using the fields on the left side of the display (see Figure 9-7 to Figure 9-12). The last active connection diagram (visible in the display) is saved upon leaving the submenu [Connection] (by pressing the  button).

3xU_{ph} + 3xI_{ph} + N: Y-connection - 5-wire system



**Figure 9-7: Connection diagram 1
(3xU_{ph} + 3xI_{ph} + N)**

This connection diagram is **generally used for asymmetrical 4- (or 5-) wire systems (low-voltage systems)**.

As represented in the above illustration, it applies to **low-voltage systems** with the protective measure protective grounding (TT system) and grounding with separate protective earth (PE conductor) (TN-S-system).

In reduced form (connector/port "UN" is not attached, "IN" to the "PEN" conductor) this connection is also used in low-voltage systems with the protective measure "grounding without separate protective earth conductor (PEN conductor)" (TN-C-system).

Y:EN50160 means, that for evaluation according to EN50160, line-to-earth voltage must be used as the EN50160 reference voltage.



Y



D

3xU_{ph} + 2xI_{ph}: Aron-connection

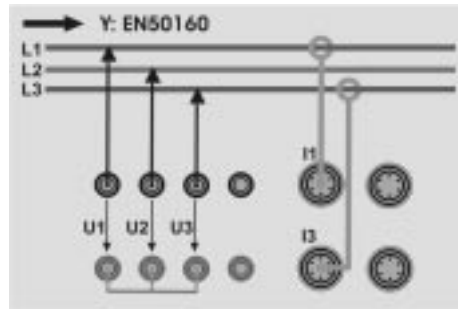


Figure 9-10: connection diagram 4
(3xU_{ph} + 2xI_{ph})

The **Aron-connection** is used for asymmetrical 3-wire systems (**medium- and high-voltage** networks without neutral conductor), for which only 2 phases are accessible for taking current - measurements.

Y:EN50160 means, that for evaluation according to EN50160, line-to-earth voltage must be used as the EN50160 reference voltage.

2xU_{line} + 2xI_{line}: V-connection

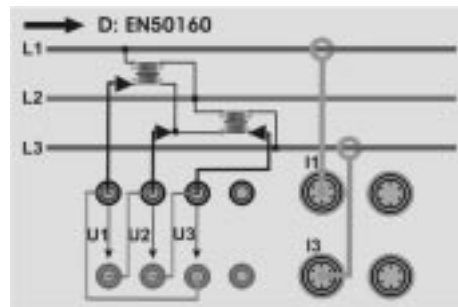
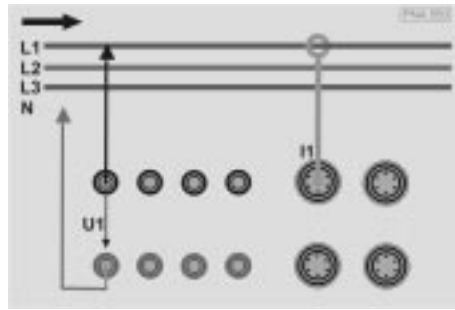


Figure 9-11: Connection diagram 5
(2xU_{line} + 2xI_{line})

This diagram is generally used for **asymmetrical 3-wire systems** (**medium voltage** network without neutral conductor), for which only 2 phases are accessible for taking measurements.

D:EN50160 means, that for evaluation according to EN50160, line-to-line voltage must be used as the EN50160 reference voltage.

1xU_{ph} + 1xI_{ph}: Single-phase-connection

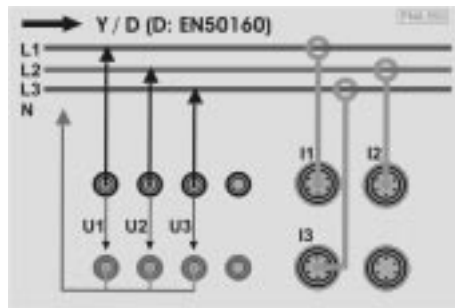


**Figure 9-12: Connection diagram 6
(1xU_{ph} + 1xI_{ph})**

The Single-phase-connection is used in **4-wire systems** in which either only 1 phase of the measurement is accessible, or the measurement of one phase is sufficient due to perfectly symmetrical load.

Use line-to-earth voltage as a reference voltage for evaluation according to EN50160.

3xU_{ph} + 3xI_{ph} Y/D: Y-connection 3-wire-system; D calculated



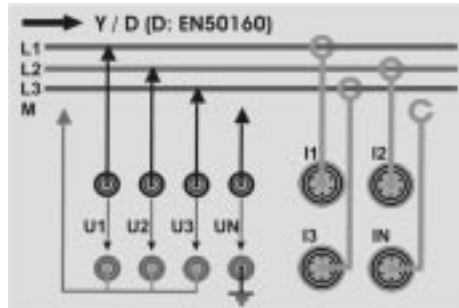
**Figure 9-13: Connection diagram 7
(3xU_{ph} + 3xI_{ph} Y/D)**

The usage of this connection diagram is intended for **medium-(and high-) voltage grids**, whose voltage measuring transformers are connected in Y (1 pole), but you want to know the line-to-line voltages

also. With this connection diagram the line-to-line voltages are calculated out of the measured line-to-earth voltages. The calculated line-to-line voltages will be used for the evaluation in the modules EN50160 and Flicker (evaluation according EN50160 needs line-to-line voltages for medium voltage grids) and ripple control signals. In the modules Oscilloscope and Transient recorder, there are line-to-line AND line-to-earth voltages available.

D:EN50160 means, that for evaluation according to EN50160, line-to-line voltage must be used as the EN50160 reference voltage.

3xU_{ph} + 3xI_{ph} Y/D + M: Y-connection 4-wire-system; D calculated



**Figure 9-14 : Connection diagram 8
(3xU_{ph} + 3xI_{ph} Y/D + M)**

The usage of this connection diagram is intended for **medium-(and high-) voltage grids**, whose voltage measuring transformers are connected in Y (1 pole), but you want to know the line-to-line voltages also. With this connection diagram the line-to-line voltages are calculated out of the measured line-to-earth voltages. The calculated line-to-line voltages will be used for the evaluation in the modules EN50160 and Flicker (evaluation according EN50160 needs line-to-line voltages for medium voltage grids) and ripple control signals. In the modules Oscilloscope and Transient recorder, there are line-to-line AND line-to-earth voltages available.

D:EN50160 means, that for evaluation according to EN50160, line-to-line voltage must be used as the EN50160 reference voltage.

Warning: Changing settings in the connection diagram affects the computation of the results in the three-phase system, i.e. on the computation of the apparent power S, the active power P, the reactive power Q, as well as on the computation of derived energy values AS, AP, AQ, etc. from these values.



The values for voltage and current are presented in the displays of the measurement module without further computation as U_1 , U_2 , U_3 , U_N and/or I_1 , I_2 , I_3 , I_N (exception: Measurement option "Vector" with application of connection diagrams 3 and 5, see next paragraph). They must be evaluated by the user according to the selected connection (see following table).

With the application of connection diagrams 3 and 5, line-to-line-voltages are measured. These voltages are converted in the measurement option "vectors" into line-to-earth-voltages (voltage factor $\frac{1}{\sqrt{3}}$, phase shift 30°) and displayed.

By usage of the connection diagrams 7 and 8, there are always phase voltages measured. For the modules oscilloscope and transient recorder however also the line voltages are available as measuring voltages (for details, see accordingly sections of the measurement modules).

The following table is a demonstration of a selection of connection diagrams and their displayed values:

Connection	Displayed values	
Connection diagram 1 (3xU _{ph} + 3xI _{ph} + N)	U₁: U _{L1-N} U₂: U _{L2-N} U₃: U _{L3-N} U_N: U _{N-PE}	I₁: I _{L1} I₂: I _{L2} I₃: I _{L3} I_N: I _N
Connection diagram 2 (3xU _{ph} + 3xI _{ph})	U₁: U _{L1-N} U₂: U _{L2-N} U₃: U _{L3-N}	I₁: I _{L1} I₂: I _{L2} I₃: I _{L3}
Connection diagram 3 (3xU _{line} + 3xI _{line})	U₁: U _{L1-L3} U₂: U _{L3-L2} U₃: U _{L2-L1}	I₁: I _{L1} I₃: I _{L3}
Connection diagram 4 (3xU _{ph} + 2xI _{ph})	U₁: U _{L1-0} U₂: U _{L2-0} U₃: U _{L3-0}	I₁: I _{L1} I₃: I _{L3}

Connection diagram 5 (2xUline + 2xlline)	U ₁ : U _{L1-L2} U ₂ : U _{L2-L3} U ₃ : U _{L3-L1}		I ₁ : I _{L1} I ₂ : I _{L2} I ₃ : I _{L3}
Connection diagram 6 (1xUph + 1xlph)	U ₁ : U _{L1-N}		I ₁ : I _{L1}
Connection diagram 7³ (3xUph + 3xlph Y/D) <div></div>	Y	U ₁ : U _{L1-N} U ₂ : U _{L2-N} U ₃ : U _{L3-N}	I ₁ : I _{L1} I ₂ : I _{L2} I ₃ : I _{L3}
	D	U ₁ : U _{L1-L2} U ₂ : U _{L2-L3} U ₃ : U _{L3-L1}	
Connection diagram 8⁵ (3xUph + 3xlph Y/D + M)	Y	U ₁ : U _{L1-N} U ₂ : U _{L2-N} U ₃ : U _{L3-N}	I ₁ : I _{L1} I ₂ : I _{L2} I ₃ : I _{L3}
	D	U ₁ : U _{L1-L2} U ₂ : U _{L2-L3} U ₃ : U _{L3-L1}	

Table 9.1: Comparison of connection diagrams - displayed values

Example: The voltage, shown as "U1", in the display, represents a line-to-earth voltage with connection diagram 1, and a line-to-line voltage with connection diagram 3.

³ In general the displayed values represent the Y-circuit values in all modules. Only in the modules oscilloscope and transient recorder a choosing between the Y- and D-values possible.

Ranges

By pressing this button, a screen appears with the measurement range parameters of the measuring instrument as last set:

The screenshot shows a 'Range Setup' screen with four rows of input fields. Each row is for a different measurement type: Voltage 1, Voltage 2, Voltage 3, and Voltage 4. Each row has a 'Voltage' field with '20V RMS' and '1.0E' options, a 'Current' field with 'Direct 5A RMS' and '1.0E' options, and a 'Back' button at the bottom right.

Figure 9-15: Display after pressing the button [Ranges]

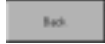
The measurement range of the current and the voltage can be specified in this field. The values selected here are saved upon leaving the submenu [Ranges] by pressing the  button.

Figure 9-16 shows an overview of the input fields:

The indicated conversion factors are factors that take into consideration the current and/or voltage transformers in the display of the C.A 8352 instrument. (e.g.: an external 2-kV voltage transformer with a 100-V output must be set to a voltage factor of 20, so that a measured voltage RMS (Root Mean Square) of 100-V appears in the displays of all C.A 8352 options (oscilloscope, FFT-analyzer, etc.) as a voltage RMS of 2-kV.

**ranges setup
for**

voltage

current

measuring range
final value

transducer
factor

measuring range
final value

transducer
factor

Ranges Setup

	measuring range final value	transducer factor	measuring range final value	transducer factor
phase L1	Voltage 1 70V RMS	K.U1 1.00	Current 1 Direct 5A RMS	K.I1 1.00
phase L2	Voltage 2 70V RMS	K.U2 1.00	Current 2 Direct 5A RMS	K.I2 1.00
Phase L3	Voltage 3 70V RMS	K.U3 1.00	Current 3 Direct 5A RMS	K.I3 1.00
Phase N	Voltage N 5V RMS	K.UN 1.00	Current N Direct 5A RMS	K.IN 1.00

Figure 9-16: Setting of the measurement range

Note:

The transformation factors offer the possibility of a reversed connection (i.e. reverse polarity; see also section 9.2, page 64) through the input of a negative transformation factor at the software level.

The input of the final measurement range values of voltage and current is done by selecting the desired field and marking the desired value in the displayed list:

The input of the **transducer factors** is done by selecting the appropriate field and entering input by means of the keyboard screen.


If certain phases are not connected in the connection diagram using the [**Connection**] button, then these fields are displayed gray; e.g. with a single-phase measurement:



By pressing this button, a screen appears with the last selected limiting parameters for the control of the Power Quality criteria according to EN50160. With the start of the submenu [EN50160], the button [50160 Limits] is in the pressed position.



Figure 9-17: Display after pressing the button [EN50160]

In this field, limit values and further specifications for the EN50160 evaluation of the signal can be confirmed and/or changed. These are activated upon leaving the submenu [EN50160] and by pressing the button .

Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option [EN50160].



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Harmon. Limits

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RVC

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Set To Default

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EN50160 Limits

The screenshot displays the 'EN50160 Setup' screen. It features a table with columns for 'Low Limit' and 'High Limit'. The parameters listed are Voltage, Flicker, THD, Unbalance, Percent [%], Hysteresis [%], Signal Frequency [Hz], and Voltage Reference Level [V]. The values for these parameters are shown in white fields. To the right of the table is a vertical scale for 'Levels for Voltage Events' ranging from 0 to 110.

	Low Limit	High Limit
Voltage	90.0 [%]	110.0 [%]
Flicker	0.0 [%]	1.0 [%]
THD	0.0 [%]	8.0 [%]
Unbalance	0.0 [%]	2.0 [%]
Percent [%]	90.0	
Hysteresis [%]	3.0	
Signal Frequency [Hz]	20.0	
Voltage Reference Level [V]	230.0	

Input is possible only in the white fields. This is done by selecting the appropriate field and entering the desired value with the keyboard screen.

Limits for evaluation according to EN50160 (see section 10.7) can be changed in the panel on the left hand side:

	Low Limit	High Limit
Voltage	97.8 [%]	118.0 [%]
Flicker	0.0	1.8
THD	0.0 [%]	6.8 [%]
Unbalance	0.0 [%]	2.8 [%]
Percentil [%]	95.8	
Hysteresis [%]	3.8	
Signal Frequency [Hz]	215.60	

- Voltage levels (in % of the reference voltage) for the 95% and the 100% percentile of the measurement period
- Flicker threshold
- THD threshold
- Unbalance factor of the 3-phase voltage system
- Week percentile
- Hysteresis (see note page 58)
- Telegram frequency, that should be used for EN50160-evaluation

Note: The telegram frequency selected here does not correspond to the telegram frequency in the module "Telegram" (see section 10.9)

Within this field, the RMS of the reference voltage and the Event-evaluation levels in % of the reference voltage can be pre-defined.

Levels for Voltage Events

118 [%]
108 [%]
98 [%]
75 [%]
65 [%]
35 [%]
15 [%]
0 [%]

Voltage Reference Level [V]

230.0

Hysteresis [%]

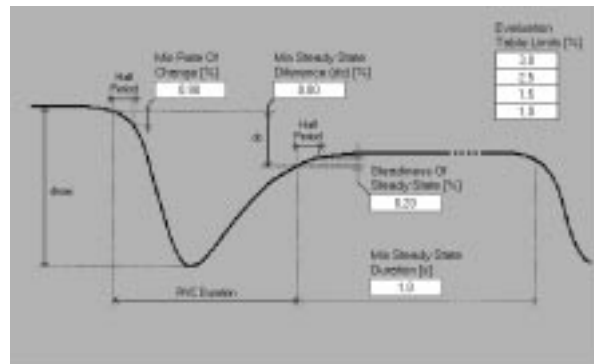
3.0

Note: When a voltage varies slightly from the set evaluation level, this will result in permanent events of no significance. In order to avoid this accumulation of unnecessary data, a bandwidth can be set (+/- hysteresis in % of the reference voltage) where, if the voltage varies within this range, no new event is recorded, e.g. event starting at 90% and ending at 92%.

EN50180 Setup			
Harmonics	High Limit	Harmonics	High Limit
Harmonic 2	2.00	Harmonic 14	0.50
Harmonic 3	5.00	Harmonic 15	0.50
Harmonic 4	1.00	Harmonic 16	0.50
Harmonic 5	6.00	Harmonic 17	2.00
Harmonic 6	0.50	Harmonic 18	0.50
Harmonic 7	5.00	Harmonic 19	1.50
Harmonic 8	0.50	Harmonic 20	0.50
Harmonic 9	1.50	Harmonic 21	0.50
Harmonic 10	0.50	Harmonic 22	0.50
Harmonic 11	3.50	Harmonic 23	1.50
Harmonic 12	0.50	Harmonic 24	0.50
Harmonic 13	3.00	Harmonic 25	1.50

Within this field limit values can be specified for the voltage RMS of the harmonics in % of the RMS of the fundamental voltage frequency.

Input is by selecting the field and entering the desired value with the keyboard screen.



This screen allows to define values for several parameters for the detection of Rapid Voltage Changes:

- Min. Rate of Change [%]: minimum difference between 2 neighboring 10ms-RMS-values in % U_N to start the RVC evaluation
- Min. Steady-State Difference (dc) [%]: minimum difference between the initial steady-state 10ms-

RMS-value and the 10ms-RMS-value of the following steady-state-condition in % U_N

- Min. Steady State Duration [s]: minimum duration in s of the 10ms-RMS-values being inside the "Steadiness-of Steady-State [%]" - limits to be detected as a steady-state-condition
- Steadiness of Steady-State [%]: hysteresis for 10ms-RMS-values to get into steady-state-condition

Input is possible only in the white fields. This is done by selecting the appropriate field and entering the desired value with the keyboard screen.

Note:

All other thresholds for the EN50160 can also be selected with the data analysis software (Post-processing).

Set To Default

Pressing this button resets all thresholds for the values of the EN50160.

Back

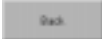
This button saves the settings and returns to the submenu [*Setup*].

PAD

After pressing this button the following screen appears:



Figure 9-18: Display after pressing the button [PAD]

Within this field, selections can be made for an additional data logger (hardware name "PAD" = programmable acquisition data logger). This is activated upon leaving the submenu [PAD] and pressing the .

Note: If no „PAD“ is attached, an error message appears. See also Manual for using "PAD"



Transient

By pressing this button, a display appears with the last set trigger settings for the transient recorder. Upon opening the submenu [Transient], the button [U] is in the pressed position.

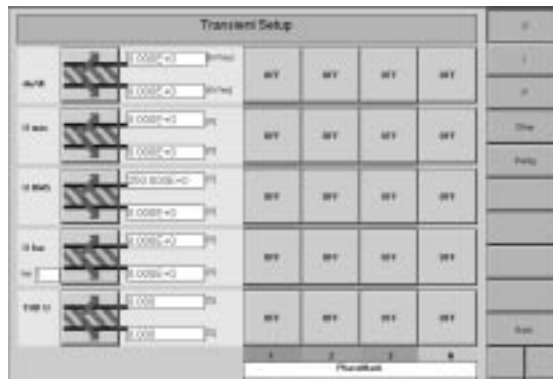



Figure 9-19: Display after pressing the button [Transient]

In this field, events with which the transient recorder activates its recording (triggers) can be pre-defined. These settings are activated upon leaving the sub-menu [Transient] and by pressing the  button.

The different possibilities for the trigger settings are described in section 10.8.



By pressing this button, a display appears with the last set parameters for detecting a telegram (ripple control signal).

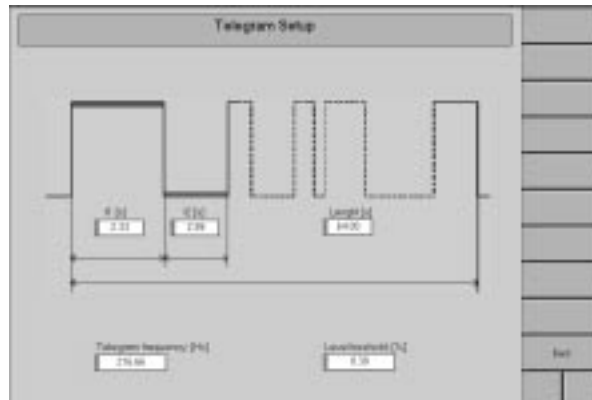
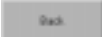


Figure 9-20: Display after pressing the button [Telegram]

In this field, the required characteristics of the ripple control signal can be pre-defined. These settings are activated upon leaving the submenu **[Telegram]** and by pressing the  button.

The description of the adjustable telegram characteristics is found in section 10.9.



After pressing the button **[Print]**, it is possible to print the set measurement settings. The „Print Panel“ appears.



There are only two possibilities to print the setup data:

[Print to BMP]: Printing (and/or saving) the setup infos as a bitmap file to the folder ...\\Data2\\User\\Project\\Printouts on the hard disc of the measurement PC (User/Project is the name of the applied project and/or user, see section 9.2.1.3.2).

[Print]: The setup info is printed on the default printer (to define a printer as a standard printer see MOP⁴ **[System]** → AP⁵ **[ST]**, section 9.4).

[Cancel]: Cancel without printing.

⁴ **Module-Options-Panel**

⁵ **Action-Panel**



Figure 9-21: Example of a Setup-printing

Actual Values

After pressing this button, a screen appears with the last set measurement settings and recorded measurement values.

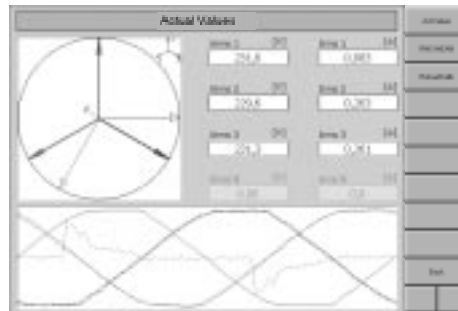
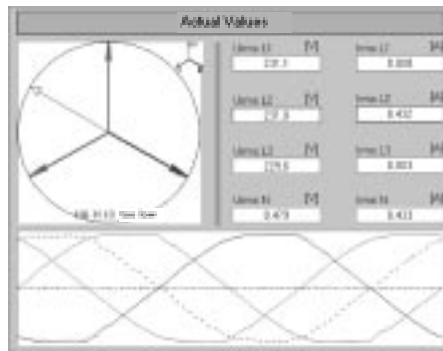


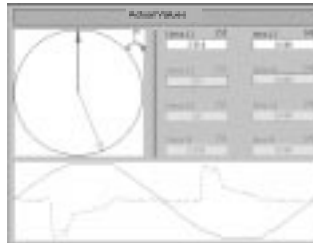
Figure 9-22: Display after pressing the button [Actual Values]

This display serves as a quick check of whether the set measurement settings are correct (connections, polarity, phase sequence, measurement range, transducer factors, etc.); and of whether the effective/selected measurement connections are also correct (current clamps connection, etc.). The measurement settings take effect upon leaving the submenu [Actual Values] and by pressing the button.

Back



The display area shows a vectorial display and the temporal process of the measurement values recorded with the current settings. At the same time, their RMS is shown in the right upper field.



If certain phases of the connection diagram are not connected, then these fields are displayed gray and/or to their graphs are not shown.



By pressing this button, all activated settings in the submenu [**Setup**] are saved, and the submenu is closed. The display changes into the output window of the module [**System**].

Options

Pressing the button [*Options*] changes the display to the following:



Figure 9-23: Display after pressing the button [*Options*]

This field serves to activate individual modules of the C.A 8352 software. By entering the license number and following confirmation by means of the button, the license number is checked and the appropriate modules are activated. The licenses and thus the corresponding license numbers for further modules of the C.A 8352 software can be purchased separately.

Back

Pressing this button returns the user to the main menu. The display changes to the output window of the module [*System*].

Info

Pressing the button **[Info]** changes the display to the following:

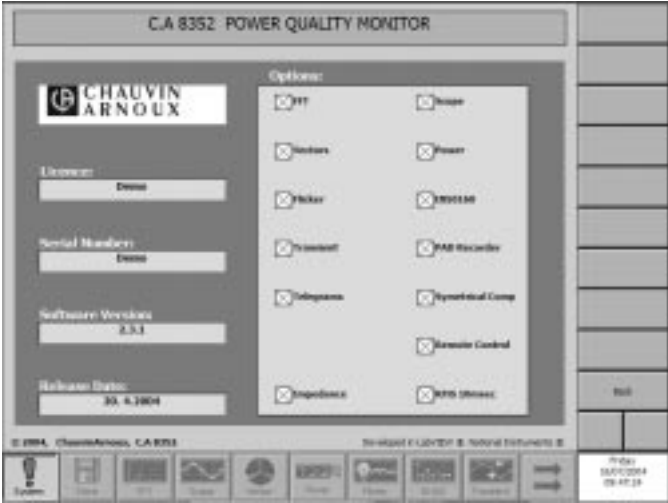



Figure 9-24: Display after pressing the button [Info]

This field serves only as information and gives information about some system parameters, such as license, serial number, software version, expiry date and shows the activated options.



Pressing this button returns the user to the main menu. The display changes to the output window of the module **[System]**.

Start Meas

By pressing the button [**Start Meas**], the recording of measurement is started. From this point, all buttons of the **Module-Options-Panel** are activated. The display of the button panel changes to . By pressing the button [**Stop Meas**], the recording of measurement is terminated and changes to the selected measurement parameters can be made.

Quit

By pressing the button **[Quit]**, the program is terminated.

A small grey rectangular button with the word "Post" in black text.

By pressing the button [*Post*], the user enters the subroutine "post-processing", which permits additional analysis of the saved measurement values (see section 11).

A small grey rectangular button with the text "ST" in black text. A yellow vertical bar is positioned to the left of the button.
A vertical yellow bar.

By pressing the button [*ST*], the user enters the subroutine „SystemTool“, with which system settings, such as printer installation, system time setting, software update etc. can be changed (see section 9.4).

9.3 Storing

In the module [**Store**], all saving-settings, such as selection of the data, which are to be saved, save interval, starting the save, procedure, etc. can be set by the user.

9.3.1 Settings in the C.A 8352 option Store



9.3.1.1 Start screen

The [**Store**] button can be operated at any time, including when recording of measurement is currently running. After pressing the button, the following screen appears:

The screen displays various settings for data storage. At the top, there are checkboxes for data types: FFT, FFT Pw, Power, Energy, Spec, Taped, Filter, 12 Hz, RND, and RMS Ip. Below these are two sections for setting intervals and start types. The first section has two rows: one for '10.0s' and another for '15 min', both with 'M' and 'E' checkboxes and 'Time' and 'Start' buttons. The second section has three rows: 'Transient', 'Telegram', and 'Alarm', each with 'C' and 'E' checkboxes and 'Time' and 'Start' buttons. At the bottom, there is a 'Free Space For' field showing 'Years: 0 Months: 8 Days: 4 Hours: 13 Minutes: 8' and a 'Disk Usage' bar graph showing a level of 8 out of 180.

Figure 9-25: Option Store

Display area:

The interface is divided into several sections. At the top, there are two rows of checkboxes for monitoring options: FFT, FFT Pwr, Power, Energy, System, Input, Flicker, TSD (T), P&D, and RMS (p). Below this is a table for recording settings with columns for Instrument, Interval, Start Type, and a Start button. The first section of the table has two rows: one with '110.2s' interval and 'H' start type, and another with '15 min' interval and 'H' start type. The second section of the table has three rows: 'Turbid' with 'C' interval, 'Telegram' with 'C' interval, and 'Alarm' with 'C' interval. At the bottom, there is a status bar showing 'Free Space For: Years: 0 Months: 0 Days: 4 Hours: 13 Minutes: 8' and a 'Disk Usage' progress bar from 0 to 100 (%).

Instrument	Interval	Start Type	Start
	110.2s	H	Start
R-50750	15 min	H	Start

Instrument	Interval	Start Type	Start
Turbid	C	H	Start
Telegram	C	H	Start
Alarm	C	H	Start

Free Space For: Years: 0 Months: 0 Days: 4 Hours: 13 Minutes: 8 Disk Usage: 0 100 (%)

The display area shows a summary of all the available options (FFT, Power, Energy, Flicker, etc.) with respect to the analyzed data and the actual active recording settings. Additionally, the available hard disk space is displayed as % of the overall capacity and in the form year-month-day-hour-minute.

Note:

Changes in the data recording parameters are possible only if no recording is currently taking place, i.e. the buttons at the right edge of the display must be active and the notation [**Start**] must appear.

Figure 9-26 and Figure 9-27 show an overview of the setting options and fields in the window:

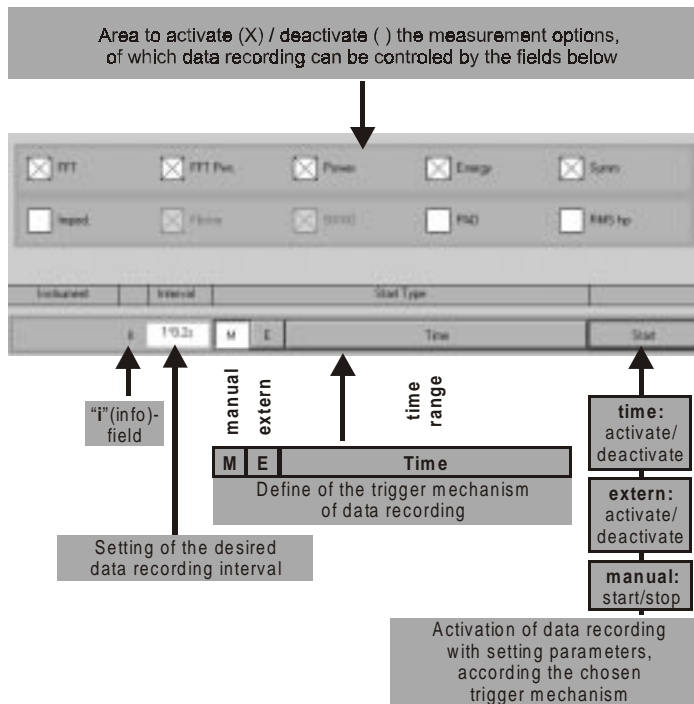


Figure 9-26:
Overview of the
upper display,
module [Store]

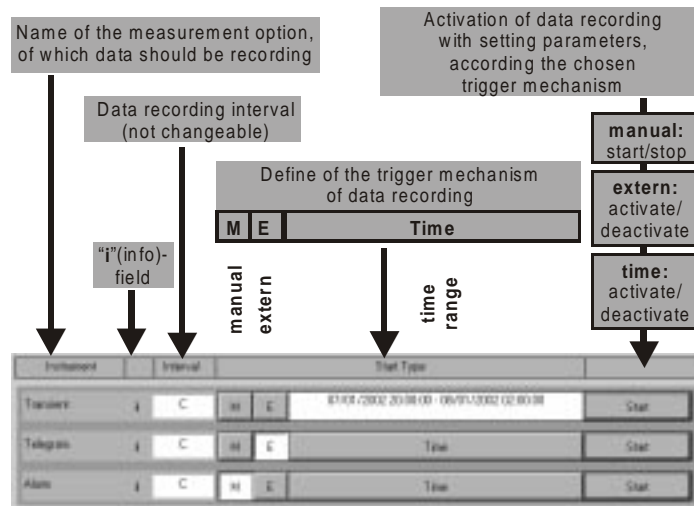


Figure 9-27:
Lower display
area of the
module [Store]

Note:

- **Activation of the measurement options** in the groups of fields in the upper display area (Figure 9-26):

By selecting the white field next to the respective measurement option, their recording is activated (X) and/or deactivated ().

Note:

- **Entering a name via the „i“(Info) – field:**

By selecting this field, a window opens in which the data records can be assigned a name corresponding to the term "measurement" in the data analysis program "C.A 8352-post" (see section 11), a measurement location and further descriptors:



Note:

- **Recording interval:**

Depending upon the application, different recording intervals are available:



C: Interval is not able to be changed here

k: Multiplication factor: Min-/Max- and Average value is stored every $k \cdot 0.2s$ (or 1min);

Example: $10 \cdot 0.2s$ means that minimum, maximum and average value of the selected parameter of the 10 0,2s evaluations is stored every 2 seconds.

The smallest recording interval corresponds to the analysis interval of 10 cycles of the basic frequency, 200ms at 50Hz.

For RMS values PNA software always stores minimum, maximum and average value of all evaluation periods (10 cycles of the fundamental frequency) of the selected storing period.

Note:

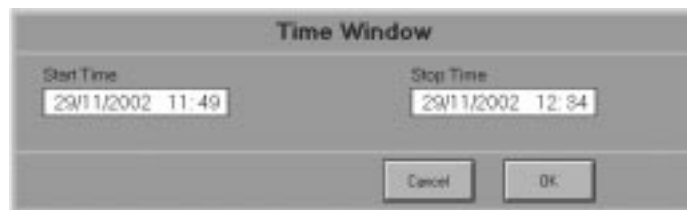
- **Trigger mechanisms:**

In each case a trigger mechanism (manual / external / temporal) can be activated.

manual: Starting and terminating the recording are done by pressing [**Start**]/[**Stop**] – button.

external: Starting and terminating the data recording can be done with an external trigger signal (depending on the type of C.A 8352).

time: Starting and terminating takes place via pressing the appropriate [**Time**] – field and entering a starting / stopping time in the display window that appears:



Note:

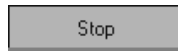
- **Activation of data recording** (depending upon set trigger mechanism):

manual: Data recording waits until operation of the [**Start**]/[**Stop**] – button.

external: Data recording waits for a trigger signal for starting and terminating the recording.

time: Activation with [**Start**] – button. Data recording waits until the start/stop time matches the time on the system clock (see section 9.4).

Note: The button [**Start**] changes with activation to [**Stop**] and changes its **color** depending upon the status of the data recording:



(gray)

Data recording is not activated.



(yellow)

Data recording is activated, however no values have been saved till now.



(green)

Data recording is activated and values have already been saved.

Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option [**Store**].



Lower button panel:



The **Module-Options-Panel**, which allows changes to other options, is shown at the lower edge of window. With the start of the C.A 8352 software (at this moment

no measurement has begun), and with terminating a current measurement, all module buttons are displayed with a gray background, with the exception of the standard options buttons **[System]** and **[Store]**. Here the option **[Store]** is selected and is therefore displayed in the pressed position.



Note: All buttons are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.


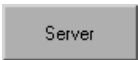
Note: Selections for saving measurement values can be made at any time in the option [**Store**], i.e. also during a current measurement.

9.3.1.2 Options and functions in detail

Settings which are necessary for the desired saving of measurement values can be specified by the user in the module [**Store**].

9.3.1.3 Right button panel: menu buttons and their functions

9.3.1.3.1 Overview

•		...Page 77
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Info

Pressing the button **[Info]** changes the screen to a tabular display of the Save status for the individual measuring options:

The screenshot shows a software interface with a sidebar on the right containing buttons for 'Info', 'Status', and several unlabeled buttons. The main area displays two tables of data.

Table 1:

Instrument	Interval	Name	Last Saved	Count
1732b		name of the record	02/12/2002 09:06:50	34
1740018		1732b		0

Table 2:

Instrument	Interval	Name	Last Saved	Count
Transmit		C	02/12/2002 09:06:50	2
Telegram		C		0
Alarm		C		0

At the bottom, there is a status bar showing 'Free Space For: Years: 0 Months: 5 Days: 16 Hours: 18 Minutes: 22' and a 'Task Usage' progress bar at 0%.

Figure 9-28: Display after pressing the button **[Info]**

In this field, names and further descriptions can be assigned to the data records. These terms assist in differentiating between data records during data evaluation by means of „C.A 8352-Post“(see section 11). All other fields serve only as indicators of status.

Figure 9-29 shows an overview of the displayed fields:

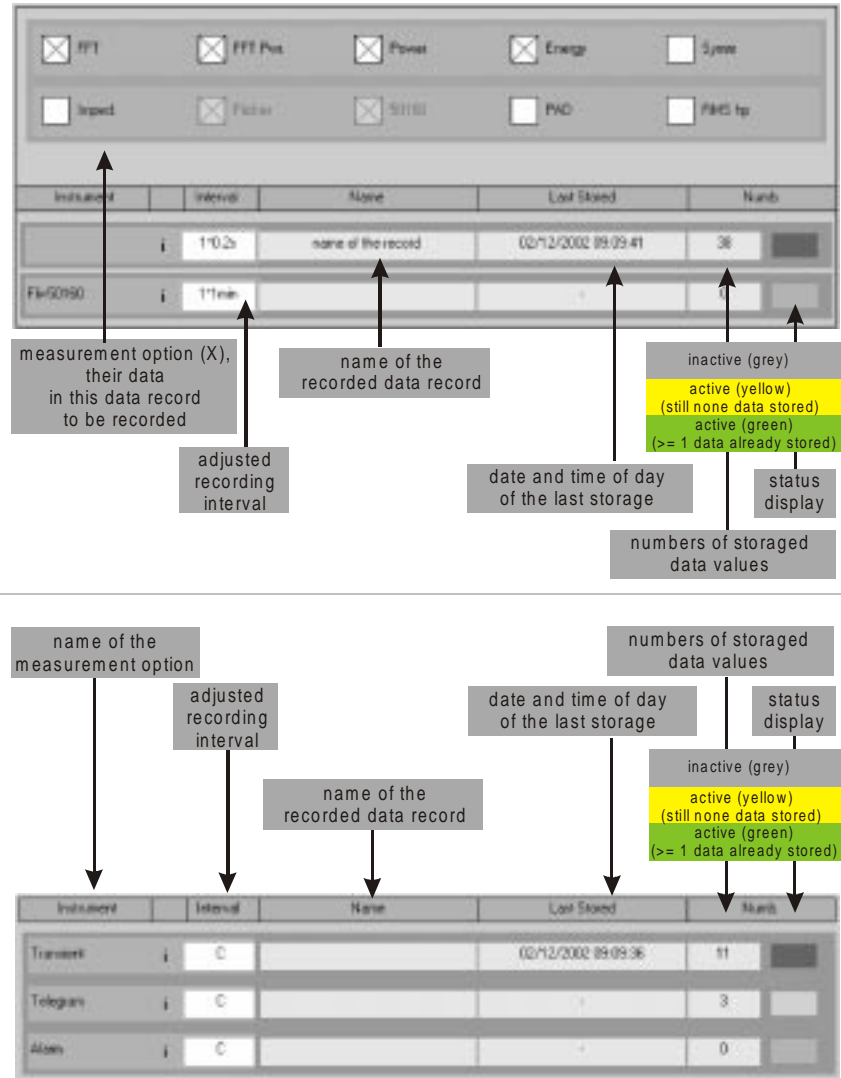


Figure 9-29: Upper and lower display area from [Info] in overview

Pressing the button **[Server]** changes the screen to a display of different control parameters for copying/replicating that allow the C.A 8352 instrument to save measurement data to a user-defined „C.A 8352 server“ (see section 9.4).



Figure 9-30: Display after pressing the button **[Server]**

Note:

For detailed information on the "C.A 8352 server" please refer to the associated description, which is available on request.



The "Replicator" is a synonym for the copying process. It is activated and/or deactivated by pressing the white field.



In this field, the user can define when and/or how the replication procedure is to be started:

- periodically after certain time intervals
- after an alarm
- after a transient recording
- by inquiry from the outside, i.e. via the program "C.A 8352 remote" from the server or from another C.A 8352 instrument
- manually.

9.4 SystemTool (system tool settings)

The „SystemTool version 3.x“ provides the settings for different system (default printer, system clock) and network parameter, the transfer of data and the activation of software updates and Hard Disk utility programs.

9.4.1 Settings/actions in the C.A 8352 option SystemTool

ST

9.4.1.1 Start screen

This is activated under the MOP⁶ [**System**] → and by pressing the button [**ST**] in the AP⁷). The following screen appears:









Figure 9-31: „SystemTool“ – start screen

⁶ Module-Options-Panel

⁷ Action-Panel

9.4.1.2 Buttons and their functions

9.4.1.2.1 Overview

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 Date/Time	... Page 83
 Printer	... Page 84
 Network	... Page 85
 Service	... Page 86
 Exit	... Page 91



After pressing the button [**Language**] a list shows all available languages for the submenu „SystemTool“. By selecting the desired language and confirming with the button



[**Switch to selected Language**] in the „Actions“ column, all terms are changed to this language.






Figure 9-32: Display after pressing the button [Language**]**






Pressing the button *[Date/Time]* activates a field within which the setting of the system clock can be changed. The following screen appears:



Figure 9-33: Display after pressing the button *[Date/Time]*

Date: By pushing on the desired date, the selected number appears as a blue encircled number (her e.g.: ). Another month can be selected by pushing the buttons  .

Time: The Time setting is also possible by mouse-click on the accordingly region of the clock (hours – selected in Figure 9-33 -, minutes, seconds) and following pressing the buttons  .

The confirmation of the date and/or time takes place by pressing the button  *[Set Systemtime]* in the „Actions“-column.



Pressing the button [*Printer*] activates a field within which a printer can be selected. This printer can be used as the standard printer in the Print Options of the respective measurement module. The following screen appears:

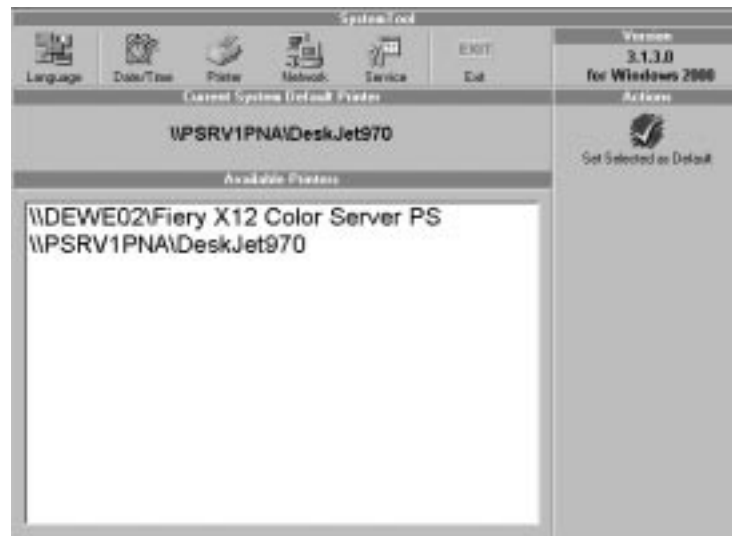


Figure 9-34: Display after pressing the button [*Printer*]

Additionally to the actual standard printer of the measurement module, all available printers are listed (*Note:* The listed printers correspond to the printers configured under MS Windows). The selection of a printer is confirmed by pressing the button



[*Set Selected as Default*] in the „Actions“- column.



By pressing the button [**Network**], the network settings can be made. The following screen appears:

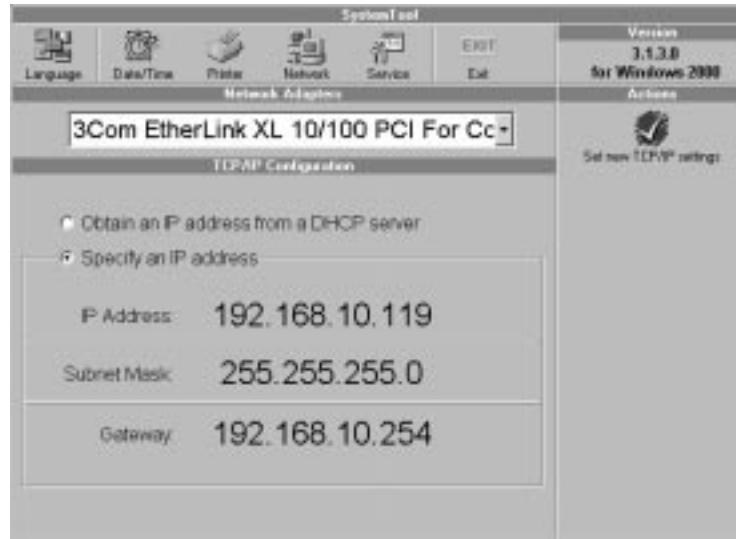


Figure 9-35: Display after pressing the button [Network**]**

Network Adapters:





The desired network connecting type can be selected in a drop down menu.

Note: The listed interfaces correspond to the network-interfaces installed under “MS Windows”.

TCP/IP Configuration:

Both the automatically IP-Address allocation (through MS Windows) and the manually allocation of the IP-Address, the Subnet Mask and the Gateway is possible. In case of manual setting the change of the address-number-blocks can be made by mouse-click on the desired address. The following screen appears:



-  ... delete number
-  .. choose address-number-block
-  ... set modification, close the keyboard-input-window
-  ... *don't* set modification, close the keyboard-input-window (cancel)

By pressing the button  [*Set new TCP/IP settings*] in the „Actions“-column, the settings become valid.



Pressing the button [*Service*] activates a field within which Hard Disk utility programs can be started. The following screen appears:



Figure 9-36: Display after pressing the button [*Service*]

Following utility programs are available:

- A data transfer program [*Data Transfer*]
- A setup program for setting the replicator function [*Setup Replicator*]



Pressing the button **[Data Transfer]** starts the program „PCLinq“ (USB Bridge Cable Application Version 1.x).

This program makes it possible for the user to access the Hard Disk of the C.A 8352 instrument from another PC. In addition, the user must also install and start the program „PCLinq“⁸ (USB Bridge Cable Application Version 1.x) on the PC from which the C.A 8352 instrument will be accessed. If the PC is connected to the C.A 8352 instrument with a USB cable, the following screen appears:

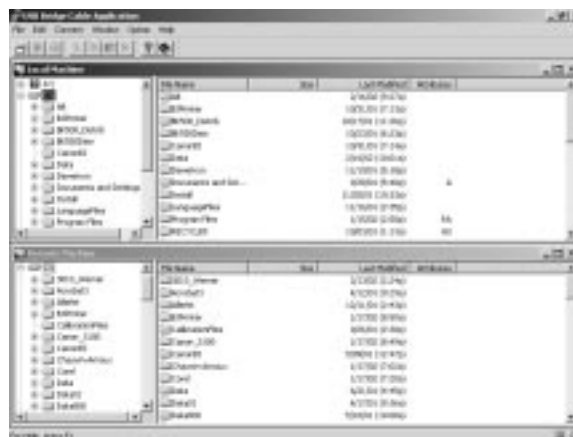


Figure 9-37: Display at activated “PCLinq” - connection

Now it is possible to access the Hard Disk of the C.A 8352 instrument (=remote machine) from the PC, e.g. copying the measurement data of the C.A 8352 instrument to the Hard Disk of the PC.

⁸ PCLing is found on the Installation CD!



After pressing the button [*Setup Replicator*] it's possible to do the settings for the replicator function.

The following screen appears:

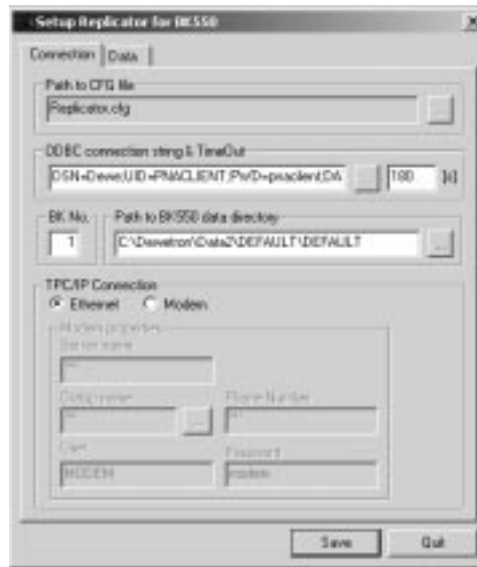


Figure 9-38: Display „Setup Replicator“- Connection

Path to CFG file:

Points to the path (and/or filename) of the file, in which all configurations are stored.


Note: This name can't be changed. It only serves as an information.

ODBC connection string & TimeOut:

The command line contains some settings, which are necessary to replicate data to a SQL database. The meaning of the terms are the following:

DSN:	Connection name of the SQL-server on which the data should be stored.
UID:	User name (user identification)
PWD:	User password
DATABASE:	Name of the data base on the SQL-server

Note: To make a valid SQL-server connection, first of all an ODBC-connection has to be installed. This connection refers to the desired SQL-server.

 : Shows the time in seconds after a break off, in which a new connection establishment to the SQL-server is tried.

BK. No.:

Shows the instrument number.

Note: Each instrument must have its own BK number. That's essential for differentiation of data on the database.

Path to BK550 data directory:

Shows the path to the data of measurement record, which are stored directly on the measurement instrument. The default-path refers to the file folder of the current defined User/Project (see section 9.2.1.3.2).

TPC/IP Connection:

As transmission protocol the most common TPC/IP protocol is used. The desired connection can be chosen:

ETHERNET: Her no further settings are necessary and/or possible.

MODEM: Following settings are possible:

- Server name (Server name) ... optional
- Connection name (Dial up name) ... mandatory
- Dial up number (Phone number) ... mandatory
- User name (User) ... optional
- User password (Password) ... optional

Note: For a valid transmission via modem, there must be installed a modem connection on the PC.

Save

Stores the taken settings.

Quit

Break off the replicator setup program.

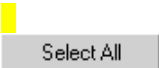


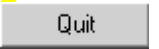
After the connection settings further settings via the table **Data** are possible. In this area additionally settings for the transmitted data can be made. The following screen appears:




Figure 9-39: Display „Setup Replicator“- Data

Here the selection of particular transmitted measurement parameter is possible.

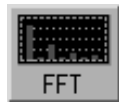
In the harmonics area, an ordinal-number-window is built by setting the upper and lower limits. If one activates for example the field *Even*, all data of the harmonics with even ordinal number are selected for the replication process (e.g.: 2 → 12 means: transmission of harmonics with ordinal number 2, 4, 6, 8, 10 and 12).

	After pressing this button all parameters are selected.
	After pressing this button no parameter is selected (erasing process).
	Saves the made settings.
	Terminate the replicator setup program.

	Pressing the button [Exit] terminates the submenu "System Tool" and returns the user to the main program „C.A 8352-Meas“.
---	--

10 Measurement

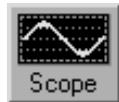
10.1 Overview of the measurement options (MOP⁹)



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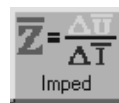
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⁹ **Module-Options-Panel**



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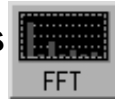


To further measurement options.



To further measurement options.

10.2 Harmonics analysis



In practice, a purely sinusoidal "sine" voltage does not occur. Instead, other cyclic voltage curves arise, which deviate more or less from the pure sine form. Figure 10.1 shows a sine voltage curve that can occur in practice.

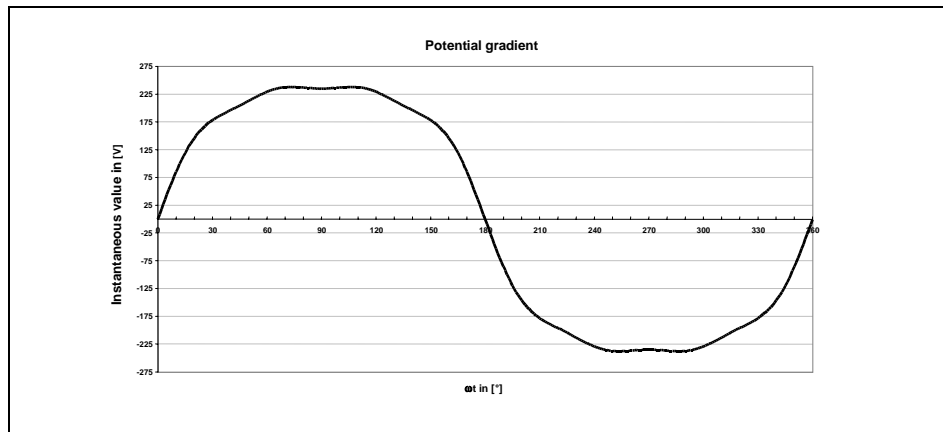


Figure 10.1: Typical voltage waveform $u(t)$

Figure 10.2 shows the breakdown of $u(t)$ into its fundamental frequencies and harmonics (Fourier components). Figure 10.3 shows the frequency spectrum of the Fourier components.

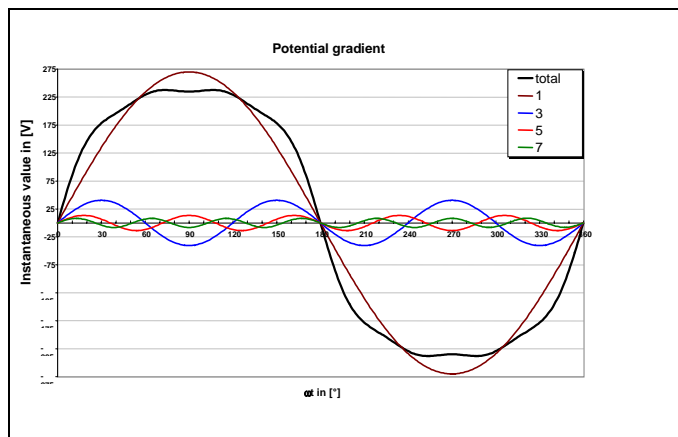


Figure 10.2:
 $u(t)$ with
fundamental
frequency and
harmonics

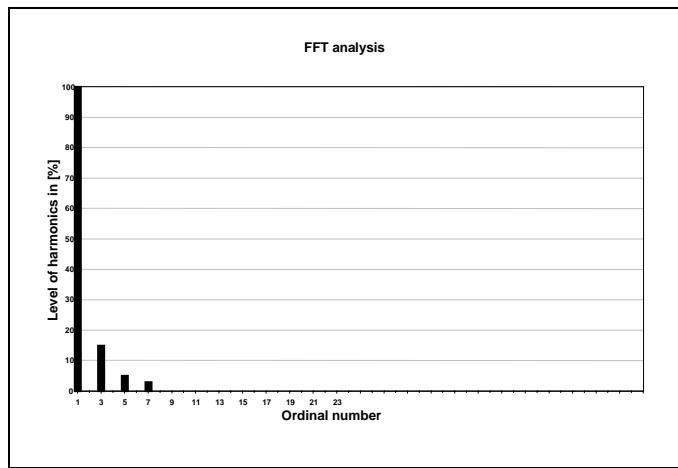



Figure 10.3:
 $u(t)$ as frequency spectrum

10.2.1 Start screen

The C.A 8352 is a high performance power quality analyzer, which makes all measurements and analysis available simultaneously and in their entirety. If the equipment settings (see section 9) have been selected and all measurement connections have been connected, measurement can be started by pressing the button  [**Start Meas**]. The Option FFT is available after pressing the button



[**FFT**]. The following display appears on the screen:

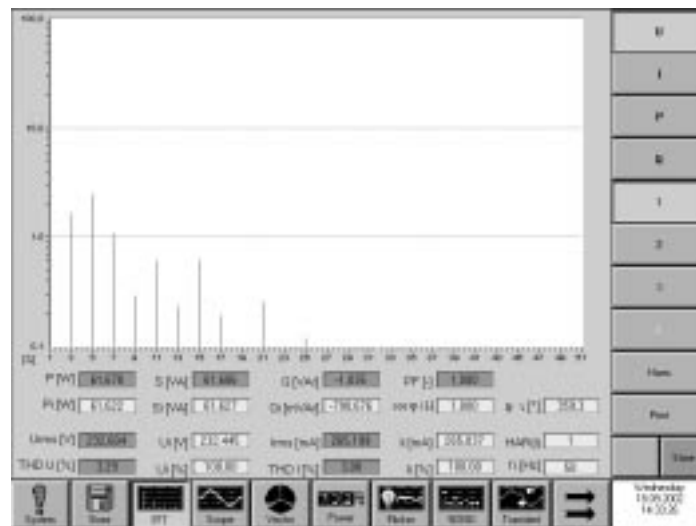


Figure 10.4: Option FFT


Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option **[FFT]** (**F**ast-**F**ourier-**T**ransformation).



Lower button panel:



The lower button panel of the window shows the **Module-Options-Panel**, which permits changing/selection of other options (all options run parallel). By pressing the button  further options become available. Here the option **[FFT]** is selected and appears therefore in the pressed position.

Note: All buttons ¹⁰ are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

¹⁰ If the appropriate modules are licensed

10.2.1.1 Options and functions in detail

The following measurements are possible with the FFT module:

Function/options	Remarks
U- level-measurement	values of the harmonics with the ordinal number $\nu = 1 - 50$ of the voltages of all associated phases (1,2,3,N)
I- level-measurement	values of the harmonics with the ordinal number $\nu = 1 - 50$ of the currents of all associated phases (1,2,3,N)
P- level-measurement	values of the harmonics with the ordinal number $\nu = 1 - 50$ of the active powers of all associated phases (1,2,3,N)
Q- level-measurement	values of the harmonics with the ordinal number $\nu = 1 - 50$ of the reactive power of all associated phases (1,2,3,N)

10.2.1.1.1 Numeric display under the Graphics window

P [W]	103,169	S [VA]	103,172	Q [VAr]	-0,797	PF [-]	1,000
Pi [W]	103,093	Si [VA]	103,096	Qi [VAr]	-0,800	cos ϕ_i [-]	1,000
ϕ_i [°]	359,6	U RMS [V]	232,5	Ui [V]	232,4	I RMS [A]	0,4438
li [A]	0,4437	HAR(i)	1	THD U [%]	2,87	Ui [%]	100,00
THD I [%]	2,66	li [%]	100,00	fi [Hz]	50,0		

Figure 10.5: Lower display area

P [W] 103,169

The number in the field with a blue background shows the total oscillation of the selected parameters (e.g.: [U] with [1]) and in each case the name is shown before the field.

Pi [W] 103,093

The number in the field with a green background shows the harmonic with the ordinal number i of the adjusted parameter (e.g.: [U] with [1]) and in each case the name is shown before the field.

The actual ordinal number i is shown in the field HARM I 1.

Harm

With this button it is possible to specify and/or select the harmonics whose values will be shown in these fields.

By pressing the button [Harm], the following window opens for input:



Figure 10.6: Keyboard window for input the ordinal number of the desired harmonic

One can enter the ordinal number of the desired harmonic with this keypad. By confirming with [Enter] this keypad disappears again. The field [History] shows the ordinal number that was last selected.

Summary of displayed parameters:






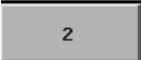
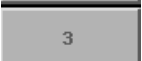





<div>P [W] 14,549</div> <div>Pi [W] 14,593</div>	Total active power and active power of the i^{th} harmonic in [W]
<div>S [VA] 103,172</div> <div>Si [VA] 103,096</div>	total apparent power and apparent power of the i^{th} harmonic in [VA]
<div>Q [VAR] -0,797</div> <div>Qi [VAR] -0,800</div>	total reactive power and reactive power of the i^{th} harmonic in [VAR]
<div>PF [-] 1,000</div>	total power factor
<div>$\cos \varphi_i$ [-] 1,000</div>	power factor ($\cos \varphi_i = \frac{P_i}{S_i}$) of the i^{th} harmonic
<div>φ_i [°] 359,6</div>	phase angle φ_i of the i^{th} harmonic
<div>U RMS [V] 232,5</div>	r.m.s. value of the total voltage in [V]
<div>THD U [%] 2,87</div>	THD value of the total voltage in [%]
<div>Ui [V] 232,4</div> <div>Ui [%] 100,00</div>	r.m.s. value of the voltage of the i^{th} harmonic in [V] and in [%]
<div>I RMS [A] 0,4438</div>	r.m.s. value of the total current in [A]
<div>THD I [%] 2,66</div>	THD value of the total current in [%]
<div>Ii [A] 0,4437</div> <div>Ii [%] 100,00</div>	r.m.s. value of the current of the i^{th} harmonic in [A] and in [%]
<div>HAR(i) 1</div> <div>fi [Hz] 50,0</div>	display of the selected ordinal number and the associated frequency in [Hz]

Note:


The meaning of the indicated values of some parameters depends upon the selected circuit diagram (see section 9.2, page 51).

10.2.1.2 Right button panel: menu buttons and their functions

10.2.1.2.1 Overview

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		... Page 104
		
		
		
		... Page 98
		... Page 105
 (gray)	 (green)	... Page 105

10.2.1.2.2 Detail

 Pressing the button **[U]** changes the screen to a display of the threshold levels of the harmonics-voltages, **U_v** ($v = 1 - 50$).

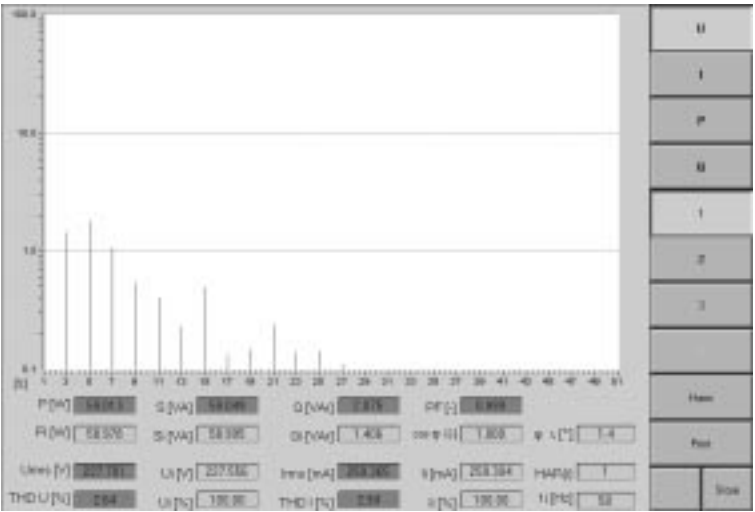


Figure 10.7: Display after pressing the buttons **[U] and **[1]****

The **horizontal axis** indicates the ordinal numbers 1 - 50 of the harmonics.

The **vertical axis** shows the voltage levels of the harmonics in [%] on a logarithmic scale.

I

Pressing the button [I] changes the screen to a display of the threshold levels of the harmonics-current, I_v ($v = 1 - 50$).

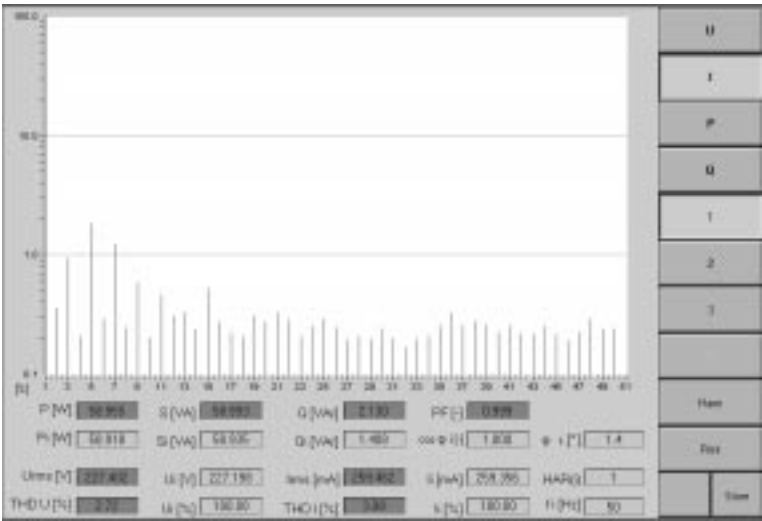


Figure 10.8: Display after pressing the buttons [I] and [1]

The **horizontal axis** indicates the ordinal numbers 1 - 50 of the harmonics.

The **vertical axis** shows the voltage levels of the harmonics in [%] on a logarithmic scale.

Pressing the button **[P]** changes the screen to a display of the threshold levels of the harmonics-active power **P_v** ($v = 1-50$). A red bar appears in the case of positive active power, and a blue bar in the case of negative active power.



Figure 10.9: Display after pressing the buttons [P] and [1]

The **horizontal axis** indicates the ordinal numbers 1 - 50 of the harmonics.

The **vertical axis** shows the voltage levels of the harmonics in [W] on a logarithmic scale.

Q

Pressing the button [Q] changes the screen to a display of the threshold levels of the harmonics-reactive power, Q_v ($v = 1-50$). A red bar appears in the case of positive reactive power, and a blue bar in the case of negative reactive power.

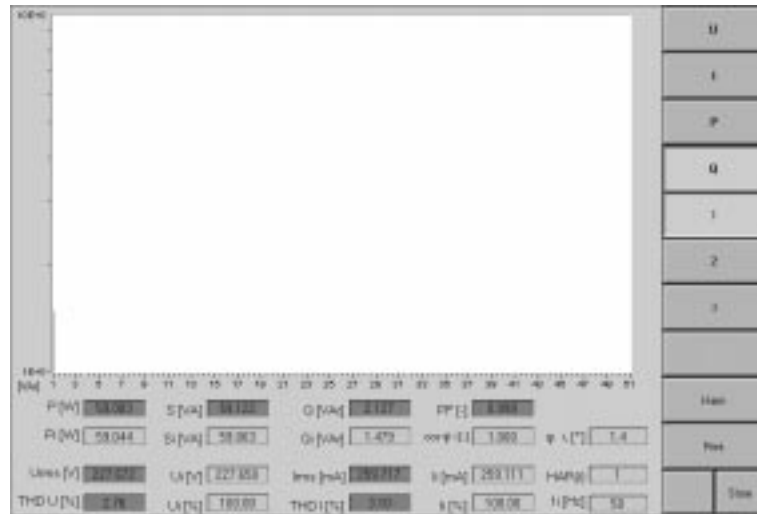


Figure 10.10: Display after pressing the buttons [Q] and [1]

The **horizontal axis** indicates the ordinal numbers 1 - 50 of the harmonics.

The **vertical axis** shows the voltage levels of the harmonics in [VAr] on a logarithmic scale.

1

2

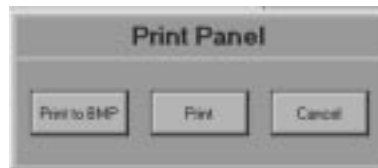
3

N

With these buttons it is possible to switch on or off each individual phase on the display screen. Only the activated phase is displayed on the screen.



After pressing the button [*Print*] the „Print Panel“ appears.



There are two possibilities to print the current screen picture:

[Print to BMP]:

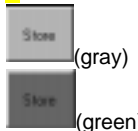
Prints (and/or stores) the current screen picture to a bitmap file. The file is saved in the folder ...\\Data2\\User\\Project_Print_Outs on the hard disk of the measurement PC (User/Project are the names of the created user and/or project, see section 9.2.1.3.2).

[Print]:

The current displayed picture is printed on the default printer (create a printer see MOP¹¹ [*System*] → APL¹² [*ST*], section 9.4).

[Cancel]:

Cancel without printing.



This button cannot be activated. It serves only as information about whether data recording is taking place or not.

Data recording is taking place, if this button is green. Data recording is activated, but there has not been any recording yet, when the button is yellow. To change to the module for data recording-setup is possible at any time by pressing the button



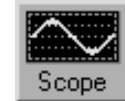
[*Store*] in the Module-Options-Panel.

¹¹ **Module-Options-Panel**



¹² **Actions-Panel**

10.3 Oscilloscope

10.3.1 Measurement by means of C.A 8352 option OSCILLOSCOPE



10.3.1.1 Start screen

The C.A 8352 is a high performance power quality analyzer, which makes all measurements and analysis available simultaneously and in their entirety. If the equipment settings (see section 9) have been selected and all measurement connections have been connected, measurement can be started by pressing the button  **[Start Meas]**. The Option OSCILLOSCOPE is available after pressing the button  **[Scope]**. The following display appears on the screen:

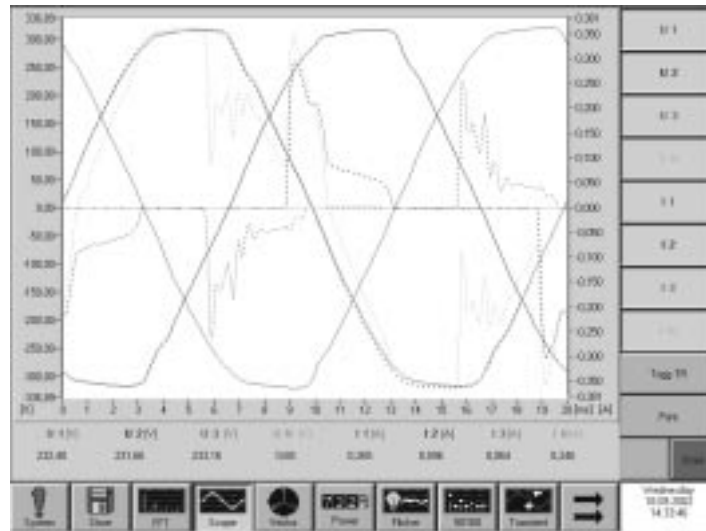


Figure 10.11: Option OSCILLOSCOPE


Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option [**Scope**] (Oscilloscope).



Lower button panel:



The lower button panel of the window shows the **Module-Options-Panel**, which permits changing/selection of other options (all options run parallel). By pressing the button  further options become available. Here the option [**Scope**] is selected and appears therefore in the pressed position.

Note:

All buttons ¹³ are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

¹³ If the appropriate modules are licensed

The **left vertical axis** shows the voltage scale for those voltage values displayed as a graph (unbroken lines: U_1 , U_2 , U_3 , U_N).

The **right vertical axis** shows the current scale for those current values displayed as a graph (dashed lines: I_1 , I_2 , I_3 , I_N).

The **horizontal axis** shows the time axis (the period of a single cycle of an oscillation).

An **information display** is found below the oscilloscope screen. This shows the actual measured r.m.s. values of each input and their available voltage and current values (here U_1 , U_2 , U_3 , U_N and I_1 , I_2 , I_3 , I_N).

U_1 [V]	U_2 [V]	U_3 [V]	U_N [V]	I_1 [A]	I_2 [A]	I_3 [A]	I_N [A]
233,2	230,8	233,7	0,00	0,097	0,264	0,262	0,0

10.3.1.2 Options and functions of the oscilloscope

With the oscilloscope module, it is possible to display measured signals in real time with auto-scaling during a single cycle graphically (in the oscilloscope) and numerically (in r.m.s. values). The following values can therefore be displayed:

Measurement value	Remarks
U_1 , U_2 , U_3 , U_N	All voltage levels (U_1 , U_2 , U_3 , U_N) are displayed both graphically as actual values during a single cycle and numerically as r.m.s. values.
I_1 , I_2 , I_3 , I_N	All current values (I_1 , I_2 , I_3 , I_N) are displayed both graphically as actual values during a single cycle and numerically as r.m.s. values.

Note: The meaning of the indicated values of some parameters depends upon the selected circuit diagram (see section 9.2, page 51).

10.3.1.3 Right button panel: menu buttons and their functions

10.3.1.3.1 Overview

U 1

U 2

U 3

U N

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I 1

I 2

I 3

I N

... Page 110

Trigg TR

... Page 110

Print

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Store (gray)

Store (green)

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Only in case of connection diagram 7 (3xUph + 3xIph Y/D) and 8 (3xUph + 3xIph Y/D + M) following buttons are additionally available:

Y

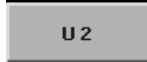
D

... Page 111

10.3.1.3.2 Detail



With these buttons, it is possible to switch on/off individual voltages. Only activated voltages are displayed on the graph.



The voltages that can be displayed and/or selected depend upon the selected circuit diagram and measurement type (see section 9.2).

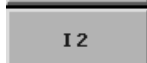


Principally, voltages are represented as unbroken lines on the graph, whereby the color coding is:

U_1 = red U_3 = green
 U_2 = blue U_N = yellow



With these buttons, it is possible to switch on/off individual currents. Only activated currents are represented as a graph.



The currents that can be displayed and/or selected depend upon the selected circuit diagram and measurement type (see section 9.2).



Principally, currents are represented as dashed lines on the graph, whereby the color coding is:

I_1 = red I_3 = green
 I_2 = blue I_N = yellow



Pressing the button [**Trigg TR**] manually triggers recording, i.e. a transient "shot" is recorded (see chapter 10.8 Transient Recorder).



By pressing the button [**Print**] the „Print Panel“ appears. Within this panel it is possible to print the current display and/or save it as a BMP-file. More about this button, see page 105.



These buttons are only available in case of connection diagram 7 (3xU_{ph} + 3xI_{ph} Y/D) and 8 (3xU_{ph} + 3xI_{ph} Y/D + M).

Showing the [**Y**] sign in the button means that the displayed voltage values are line-to-earth values (Y-circuit). After pressing the button [**Y**] the sign changes to [**D**].

Showing the [**D**] sign in the button means that the displayed voltage values are line-to-line values (delta circuit).





This button cannot be activated. It serves only as information about whether data recording is taking place or not.

Data recording is taking place, if this button is green. Data recording is activated, but there has not been any recording yet, when the button is yellow. To change to the module for data recording is possible at any time by pressing the button

[**Store**] in the Module-Options-Panel.

10.4 Vector diagram

10.4.1 Start screen

The C.A 8352 is a high performance power quality analyzer, which makes all measurements and analysis available simultaneously and in their entirety. If the equipment settings (see section 9) have been selected and all measurement connections have been connected, measurement can be started by pressing the button  [**Start Meas**]. The Option VECTOR is available after pressing the button  [**Vector**]. The following display appears on the screen:

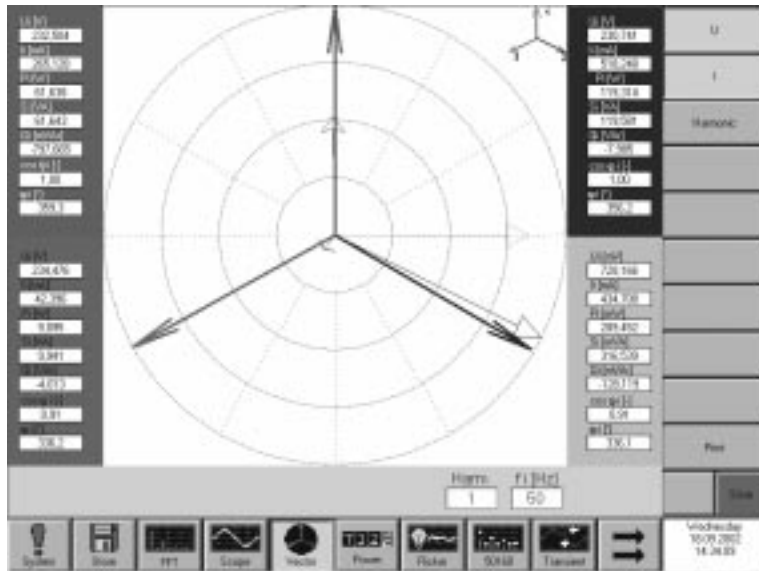


Figure 10.12: Option VECTOR


Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option [**Vector**].



Lower button panel:



The lower button panel of the window shows the **Module-Options-Panel**, which permits changing/selection of other options (all options run parallel). By pressing the button  further options become available. Here the option [**Vector**] is selected and appears therefore in the pressed position.

Note:

All buttons ¹⁴ are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

U_i [V]	134,764
I_i [mA]	68,424
P_i [W]	0,000
S_i [VA]	5,316
Q_i [VAr]	-5,292
$\cos \varphi_i$ [-]	NaN
φ_i [°]	305,43

The colored bars (here the bar are for phase 1) contain the actual values for voltage RMS U_i current RMS, I_i , active power, P_i , apparent power S_i reactive power Q_i as well as the power factor $\cos \varphi_i$ and the phase shift φ_i measured at this circuit. The **index i** thus indicates the ordinal number of the selected harmonics and/or inter-harmonics (for harmonic selection, refer to section 10.4.1.2 under button [**Harmonic**]).

Color representation: Phase 1 = red Phase 3 = green
 Phase 2 = blue Neutral = yellow

¹⁴ If the appropriate modules are licensed

Note: For the gray bars (appear shaded) see section 10.4.1.2 under button **[U]** and/or **[I]**.

The **control and information displays** are under the vector diagram. The ordinal number is shown for the harmonics and/or inter-harmonics (here 1 corresponds fundamental wave) that have been selected for graphical and numeric display (for selection of the ordinal number see section 10.4.1.2 under the button **[Harmonic]**). Additionally, this panel indicates the values for which no measurement signal is available (here U_1 and I_1) via the label "**Low**".

If you do not select to display **[U]** and **[I]** together at the same time, you can see the phase angles for the displayed vectors (with signal U_1 as the reference angle 0°).

Phi: $I_1=44.4^\circ$ $I_2=125.2^\circ$ $I_3=66.2^\circ$	Harmon	f i [Hz]
	1	50

Note: If through the selection of circuit diagrams, the measurement of a certain input is not provided for, these will not be shown in the information display under the label "Low".

10.4.1.1 Options and functions of the vector option

A graphical (in a vector diagram) and numerical display of the following values is possible with the vector module.

Measurement value	Remarks
U	All voltage-r.m.s. values (U_1 , U_2 , U_3 , U_N) at the connections will be displayed both <i>graphically</i> and <i>numerically</i> . The selected harmonics and/or inter-harmonics are displayed. Displayed values generally represent r.m.s. values .

I	<p>All current-r.m.s. values (I_1, I_2, I_3, I_N) at the connections will be displayed (both <i>graphically</i> and <i>numerically</i>).</p> <p>The selected harmonics and/or inter-harmonics are displayed.</p> <p>Displayed values generally represent r.m.s. values.</p>
P, S, Q $\cos\phi$, ϕ	<p>The values P (active power), S (apparent power), Q (reactive power), $\cos\phi$ (power factor), ϕ (phase shift between current and voltage) of the individual connections (1, 2, 3, N) are <i>numerically</i> displayed.</p>

Note:

The meaning of the indicated values of some parameters depends upon the selected circuit diagram (see section 9.2, page 51).

10.4.1.2 Right button panel: menu buttons and their functions

Note:

All buttons ¹⁵ are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

10.4.1.2.1 Overview

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 (gray)  (green)	... Page 118

¹⁵ If the appropriate modules are licensed

10.4.1.2.2 Detail



With this button, it is possible to display the r.m.s. values of all the harmonics of the connected voltages (U_1 , U_2 , U_3 , U_N) as vectors.

Principally, voltages are represented as unbroken lines on the graph, whereby the color coding is:

U_1 = red U_3 = green
 U_2 = blue U_N = yellow

Note:

It is for the voltage display only, therefore the button **[U]**, when activated, causes the vector display to be scaled with numeric values (see Figure 10.13: Numeric voltage-display in the vector diagram

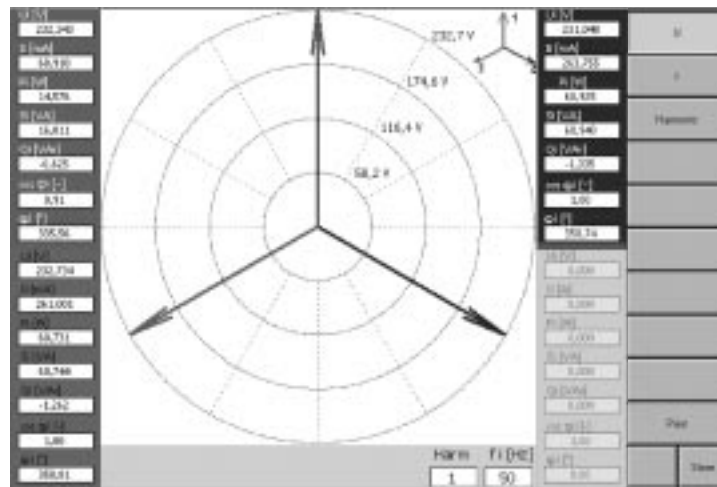


Figure 10.13: Numeric voltage-display in the vector diagram

In Figure 10.13: Numeric voltage-display in the vector diagram the gray shaded numerical fields (here in the yellow bar) indicate that these connections (here, N), depending on the selected circuit diagram, are not measured.

I

With this button, it is possible to display the r.m.s. values of all the harmonics of the connected currents (I_1 , I_2 , I_3 , I_N) as vectors.

Generally, currents are represented as dashed lines on the graph, whereby the color coding is:

I_1 = red I_3 = green
 I_2 = blue I_N = yellow

Note:

It is for the current display only, therefore the button [I], when activated, causes the vector display to be scaled with numeric values (see Figure 10.14: Numeric current-display in the vector diagram

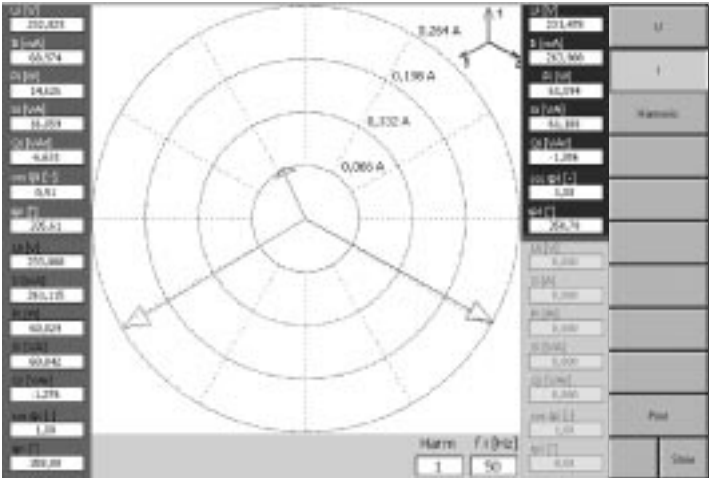


Figure 10.14: Numeric current-display in the vector diagram

In Figure 10.14: Numeric current-display in the vector diagram the gray shaded numerical fields (here in the yellow bar) indicate that these connections (here, N), depending on the selected circuit diagram, are not measured.



By pressing the button [**Harmonic**], the following window opens for input of the ordinal number of the harmonic or inter-harmonic that is to be graphically or numerically displayed:



Figure 10.15: Keyboard window for input of the ordinal number i of the desired harmonic

One can enter the ordinal number of the desired harmonic with this keypad. By confirming with [**Enter**] the input value is accepted and the keypad disappears. By pressing the button [**Esc**] the input is cancelled without accepting the input value. The field [**History**] shows the ordinal number that was last selected. By pressing the button [**Copy**] the value in the field "History" is input into the input field.


Note: A double click on the field „Harm“ in the control display opens similarly the input window.



By pressing the button [**Print**] the „Print Panel“ appears. Within this panel it is possible to print the current display and/or save it as a BMP-file. More about this button, see page 105.



This button cannot be activated. It serves only as information about whether data recording is taking place or not.

Data recording is taking place, if this button is green. Data recording is activated, but there has not been any recording yet, when the button is yellow. To change to the module for data recording is possible at any time by pressing the button 


[**Store**] in the Module-Options-Panel.

10.5 Power and Energy Analyzer

10.5.1 Measurement by means of the C.A 8352 option POWER



10.5.1.1 Start screen

The C.A 8352 is a high performance power quality analyzer, which makes all measurements and analysis available simultaneously and in their entirety. If the equipment settings (see section 9) have been selected and all measurement connections have been connected, measurement can be started by pressing the button  [Start Meas]. The Option POWER is available after pressing the button

 [Power]. The following display appears on the screen:

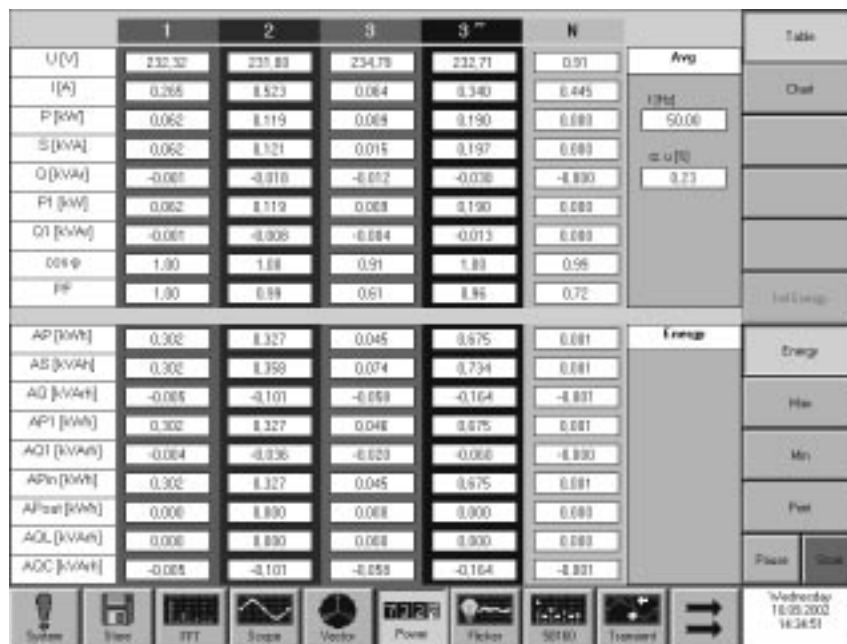


Figure 10.16: Option POWER


Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option [**Power**].



Lower button panel:



The lower button panel of the window shows the **Module-Options-Panel**, which permits changing/selection of other options (all options run parallel). By pressing the button  further options become available. Here the option [**Power**] is selected and appears therefore in the pressed position.

Note: All buttons ¹⁶ are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

10.5.1.2 Options and functions in detail

The following measurements are possible with the Power module:

Functions/ Options	Remarks
U in [V]	<i>voltage r.m.s value</i> , of all connections (1, 2, 3, N and 3-phase)
I in [A]	<i>current r.m.s. value</i> of all connections (1, 2, 3, N and 3-phase)

¹⁶ If the appropriate modules are licensed

P in [kW]	<i>active power of all connections (1, 2, 3, N and 3-phase)</i>
S in [kVA]	<i>apparent power of all connections (1, 2, 3, N and 3-phase)</i>
Q in [kVAr]	<i>reactive power of all connections (1, 2, 3, N and 3-phase)</i>
P1 in [kW]	<i>active power of the fundamental harmonic of all connections (1, 2, 3, N and 3-phase)</i>
Q1 in [kVAr]	<i>reactive power of the fundamental harmonic of all connections (1, 2, 3, N and 3-phase)</i>
$\cos \varphi$	<i>power factor of the fundamental harmonic of all connections (1, 2, 3, N and 3-phase)</i>
PF	<i>total power factor of all connections (1, 2, 3, N and 3-phase)</i>
AP in [kWh]	<i>active energy (power consumption) of all connections (1, 2, 3, N and 3-phase)</i>
AS in [kVA]	<i>apparent energy (power consumption) of all connections (1, 2, 3, N and 3-phase)</i>
AQ in [kVAr]	<i>reactive energy (power consumption) of all connections (1, 2, 3, N and 3-phase)</i>
AP1 in [kWh]	<i>active energy of the fundamental harmonic (power consumption) of all connections (1, 2, 3, N and 3-phase)</i>
AQ1 in [kVAr]	<i>reactive energy of the fundamental harmonic (power consumption) of all connections (1, 2, 3, N and 3-phase)</i>
APin in [kWh]	<i>applied active energy (power consumption) of all connections (1, 2, 3, N and 3-phase)</i>
APout in [kWh]	<i>produced active energy (power consumption) of all connections (1, 2, 3, N and 3-phase)</i>
AQL in [kVAr]	<i>applied inductive reactive energy (power consumption) of all connections (1, 2, 3, N and 3-phase)</i>
AQC in [kVAr]	<i>applied capacitive reactive power (power consumption) of all connections (1, 2, 3, N and 3-phase)</i>
f in [Hz]	<i>mean frequency of the connections (1, 2, 3)</i>
αu in [%]	<i>unbalance factor of the voltage</i>

Note: The meaning of the indicated values of some parameters depends upon the selected circuit diagram (see section 9.2, page 51).

10.5.1.3 *Right button panel: menu buttons and their functions*

10.5.1.3.1 *Overview*

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	L2	
	L3	
	N	
	T	
Print		... Page 127
Pause		... Page 127
Store (gray)	Store (green)	... Page 127

10.5.1.3.2 Detail



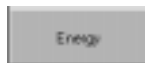
After pressing this button, a tabular listing of **instantaneous values** of various measurement parameters (e.g. voltage, current and power parameters) appears in the upper area of the display:

indicated parameter	of phase L1	of phase L2	of phase L3	of the three-phase system	of phase N	
	1	2	3	3~	N	Avg
U [V]	234,2	232,9	233,9	233,7	0,0	
I [A]	0,098	0,265	0,262	0,222	0,000	
P [kW]	0,015	0,062	0,061	0,138	0,000	
S [kVA]	0,016	0,062	0,061	0,156	0,000	
Q [kVar]	-0,007	-0,001	-0,001	-0,009	0,000	f [Hz] 50,00
P1 [kW]	0,015	0,062	0,061	0,137	0,000	α u [%] 0,12
Q1 [kVar]	-0,007	-0,001	-0,001	-0,009	0,000	
cos φ	0,91	1,00	1,00	1,00	0,00	
PF	0,91	1,00	1,00	0,88	0,00	

**Figure 10.17: Upper display area
in the module [Power] – option „Table“**

The meaning of the indicated parameters is described in section 10.5.1.2 „Options and functions in detail“.

In the lower display area, depending upon the set display mode, different values are shown:



- **Display in "Energy" mode:**

This mode is activated when the button [Energy] is pressed.
It shows a listing of all energies measured since the last initialization (see page 124):

indicated parameter	of phase L1	of phase L2	of phase L3	of the three-phase system	of phase N	
AP [kWh]	0,020	0,020	0,020	0,060	0,000	Energie
AS [kVAh]	0,020	0,020	0,020	0,061	0,000	
AQ [kVAh]	-0,000	-0,000	-0,000	-0,001	0,000	
AP1 [kWh]	0,020	0,020	0,020	0,060	0,000	
AQ1 [kVAh]	-0,000	-0,000	-0,000	-0,001	0,000	
APin [kWh]	0,020	0,020	0,020	0,060	0,000	
APout [kWh]	0,000	0,000	0,000	0,000	0,000	
AQL [kVAh]	0,000	0,000	0,000	0,000	0,000	
AQC [kVAh]	-0,000	-0,000	-0,000	-0,001	0,000	

**Figure 10.18: Lower display area in the module [Power]
– option „Table“ – „Energy“- mode**

The meaning of the indicated parameters is described in section 10.5.1.2 „Options and functions in detail“.



By pressing the button **[Init Energy]** the display of all indicated energy values (AP, AS, AQ, ...AQC) is set to the value 0.



- **Display in the „Maximum“ – mode:**

This mode is activated by pressing the button **[Max]**.

It shows the **maximum values** of different measurement parameters of the last save interval (for setting the memory interval, see section 9.3)

indicated parameter	of phase L1	of phase L2	of phase L3	of the three-phase system	of phase N	
U [V] max	233,4	231,9	233,9	233,1	0,000	Max
I [A] max	0,096	0,267	0,262	0,223	0,000	
P [kW] max	0,014	0,062	0,061	0,138	0,000	f [Hz]
S [kVA] max	0,016	0,062	0,061	0,156	0,000	90,00
Q [kVar] max	-0,006	-0,001	-0,001	-0,009	0,000	α u [%]
P1 [kW] max	0,014	0,062	0,061	0,137	0,000	0,27
Q1 [kVar]	-0,006	-0,001	-0,001	-0,009	0,000	Time Min/Max
cos max	0,91	1,00	1,00	1,00	0,000	14.03.2002
PF max	0,91	1,00	1,00	0,88	0,000	14:52:00

Figure 10.19: Lower display area in the module [Power] – option „Table“ – „Maximum“- mode

The meaning of the indicated parameters is described in section 10.5.1.2 „Options and functions in detail“. The field "Time Min/Max" shows the date and time at the completion of the last save interval.

Min

- **Display in the „Minimum“ – mode:**

This mode is activated by pressing the button [Min]. It shows the **minimum values** of different measurement parameters of the last save interval (for setting the memory interval, see section 9.3)

indicated parameter	of phase L1	of phase L2	of phase L3	of the three-phase systems	of phase N	
U [V] min	232,5	232,0	233,3	232,8	0,000	Min
I [A] min	0,096	0,267	0,261	0,223	0,000	
P [kW] min	0,015	0,062	0,061	0,138	0,000	f [Hz]
S [kVA] min	0,016	0,062	0,061	0,156	0,000	49,98
Q [kVar] min	-0,007	-0,001	-0,001	-0,009	0,000	α u [%]
P1 [kW] min	0,015	0,062	0,061	0,138	0,000	0,14
Q1 [kVar]	-0,007	-0,001	-0,001	-0,009	0,000	Time Min/Max
cos min	0,91	1,00	1,00	1,00	0,000	14.03.2002
PF min	0,91	1,00	1,00	0,88	0,000	15:02:00

Figure 10.20: Lower display area in the module [Power] – option „Table“ – „Minimum“-mode

The meaning of the indicated parameters is described in section 10.5.1.2 „Options and functions in detail“.

The field "Time Min/Max" shows the date and time at the completion of the last save interval.

Chart

After pressing this button, a time dependence display appears of U, I, P and Q for all connected phases.

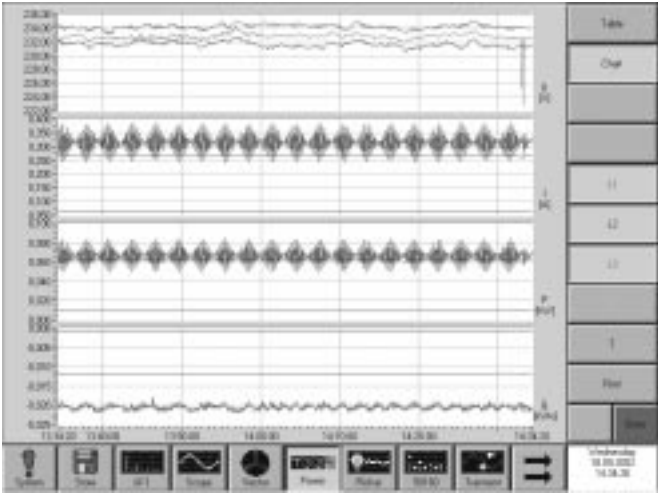


Figure 10.21: Display after pressing the button [Chart]

L1
L2
L3
N
T

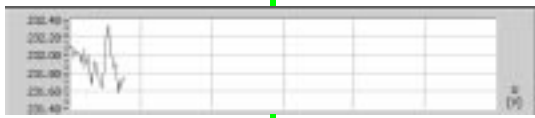
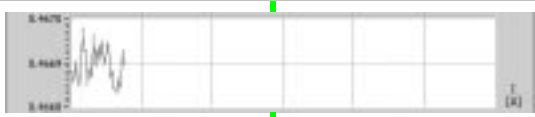
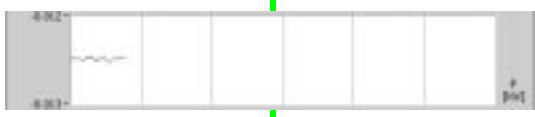

With these buttons, it is possible to switch on/off each individual phase on the display. Only the activated phases are shown on the display and their buttons appear in the pressed position, e.g.:

L1

.

Overview of the displayed diagrams:

The **horizontal axis** is the time axis and is scaled in 10-minute-intervals. The scaling of the **vertical axis** of the diagrams dynamically follows the corresponding measured values.

	Time dependence of the <i>voltage r.m.s. values</i> of the set phases in [V]
	Time dependence of the <i>current r.m.s. values</i> of the set phases in [A]
	Time dependence of the <i>active power</i> of the set phases in [kW]
	Time dependence of the <i>reactive power</i> of the set phases in [kVar]



By pressing the button [**Print**] the „Print Panel“ appears. Within this panel it is possible to print the current display and/or save it as a BMP-file. More about this button, see page 105.



Pressing the button [**Pause**] “freezes” the actual displayed values (the [**Pause**] button is displayed in the pressed position). The indicated values are again updated by pressing this button again.



(gray)



(green)

This button cannot be activated. It serves only as information about whether data recording is taking place or not.

Data recording is taking place, if this button is green. Data recording is activated, but there has not been any recording yet, when the button is yellow. To change to the module for data recording is possible at any time by pressing the button





[**Store**] in the Module-Options-Panel.

10.6 Flicker meter

10.6.1 Measurement by means of the C.A 8352 option FLICKER



10.6.1.1 Start screen

The C.A 8352 is a high performance power quality analyzer, which makes all measurements and analysis available simultaneously and in their entirety. If the equipment settings (see section 9) have been selected and all measurement connections have been connected, measurement can be started by pressing the button  [Start Meas]. The Option FLICKER-METER is available after pressing the button  [Flicker]. The following display appears on the screen:

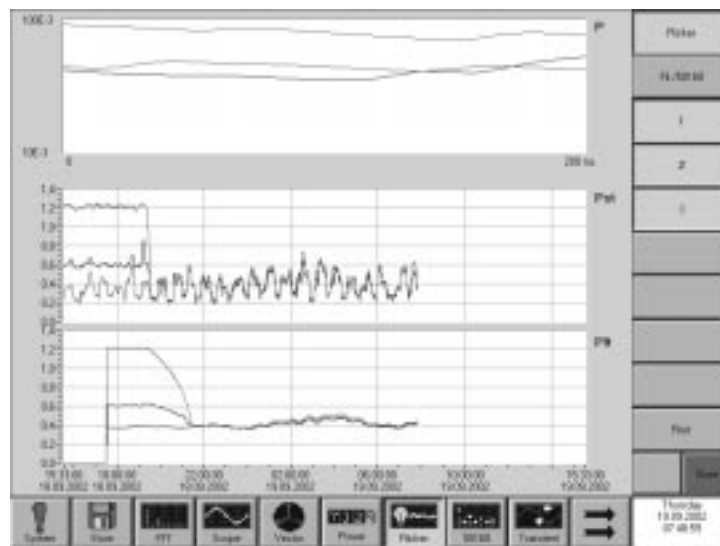


Figure 10.22: Option FLICKER METER

Note: If a measurement has already been started, a screen with "Wait for flicker filter" appears for 2 minutes in the upper window.

Wait for flicker filter.


Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option **[Flicker]** (Flicker meter).



Lower button panel:



The lower button panel of the window shows the **Module-Options-Panel**, which permits changing/selection of other options (all options run parallel). By pressing the button  further options become available. Here the option **[Flicker]** is selected and appears therefore in the pressed position.

Note: All buttons¹⁷ are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

10.6.1.2 Options and functions in detail

With the Flicker Meter module the following measurements are possible:

Measurement value / Functions	Remarks
$P_{(t)}$ - Measurement	current flicker strength (display range 200 ms)
P_{st} - Measurement	short term flicker measurement ¹⁸
P_{lt} - Measurement	long term flicker measurement ¹⁹

Note: The meaning of the indicated values of some parameters depends upon the selected circuit diagram (see section 9.2, page 51).

¹⁷ If the appropriate modules are licensed

¹⁸ P_{st} with a interval $T_{st} = 10$ min (according to standard IEC 61000-4-15 & EN50160)

¹⁹ P_{lt} with a interval $T_{lt} = 2$ h (according to standard IEC 61000-4-15 & EN50160)

10.6.1.3 Right button panel: menu buttons and their functions

Note: All buttons²⁰ are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

10.6.1.3.1 Overview

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 (gray)  (green)	... Page 133

²⁰ If the appropriate modules are licensed

10.6.1.3.2 Detail

Flicker

Pressing the button [*Flicker*] changes the screen to the following display:

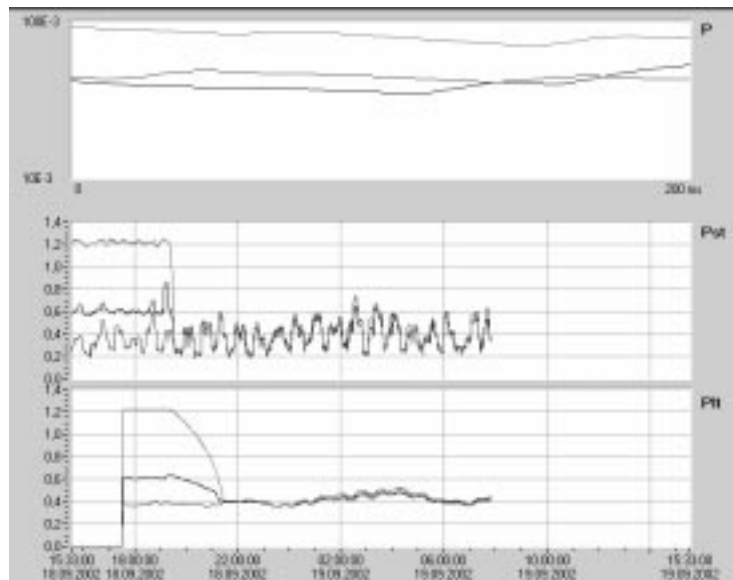


Figure 10.23: Display after pressing the button [*Flicker*]

The window is partitioned so that three diagrams can fit in it. The uppermost diagram shows the **flicker value, P , currently being measured over a time window of 200 ms.**

The second diagram shows the measured **short-term flicker P_{st}** (the value with a short-term interval of 10 min, calculated statistically according to the relevant regulations and standards).

The third diagram shows the measured **long-term flicker P_{lt}** (the value with a long-term interval of 120 min = 2h, calculated statistically according to the relevant regulations and standards).

The value of the flicker strength is shown on the **vertical axis** and the **horizontal axis** shows the time interval of the measurement, with time and date, over a time window of 24 h.

Note: This flicker display contains **all measurement values**, i.e. with the computation of the displayed values, **no correction** is made according to IEC 61000-4-30²¹.

Fli./50160

Pressing the button [**Fli./50160**] does not change the structure of the screen display. For the description of the individual normal ranges, see the description of the button [**Flicker**], page 131.

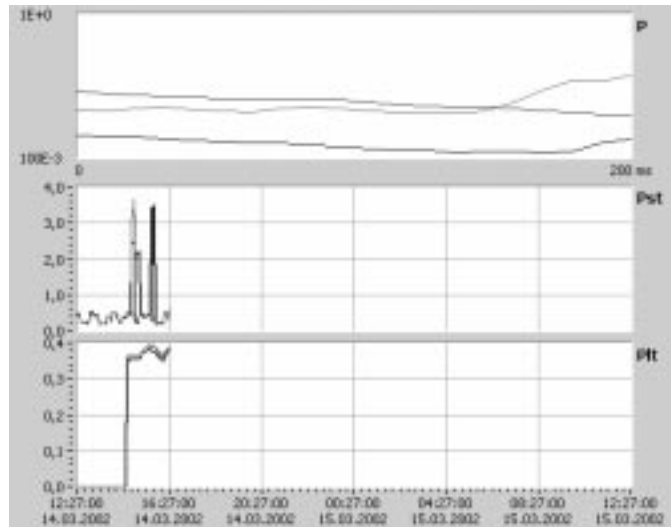


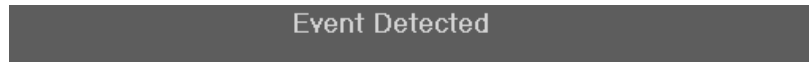
Figure 10.24: Display by activated button [**Fli./50160**]

In the available display mode (see Fig. 10.24), **corrections** are made to the measured values **regarding special interruptions, disruptions and increases of the measured voltage**. These special interruptions, etc. are those, which are defined according to EN 50160 as as "**events**" (so-called "flagged" measured values), as they are **interruptions, dips/sags and swells**. The display in this mode shows (final) measurement values, i.e. the flicker values without the calculation of these "special" events²².

²¹ Flagging concept for interruptions, dips/sags and swells (for further details see [2]).

²² See [2]

Note: When one of these "events" is detected, the display "Event Detected" appears in the upper window.



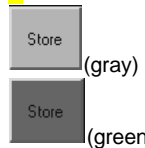
This display occurs in both display modes.




With these buttons, it is possible to switch individual phases on or off. Only activated phases are displayed as graphs.



By pressing the button [**Print**] the „Print Panel“ appears. Within this panel it is possible to print the current display and/or save it as a BMP-file. More about this button, see page 105.





This button cannot be activated. It serves only as information about whether data recording is taking place or not.

Data recording is taking place, if this button is green. Data recording is activated, but there has not been any recording yet, when the button is yellow. To change to the module for data recording is possible at any time by pressing the button 

[**Store**] in the Module-Options-Panel.

10.7 EN 50160²³
(Characteristics of the voltage in public power supply grids)

10.7.1 Start screen

The C.A 8352 is a high performance power quality analyzer, which makes all measurements and analysis available simultaneously and in their entirety. If the equipment settings (see section 9) have been selected and all measurement connections have been connected, measurement can be started by pressing the button  [*Start Meas*]. The Option 50160 is available after pressing the button  [*50160*]. The following display appears on the screen:

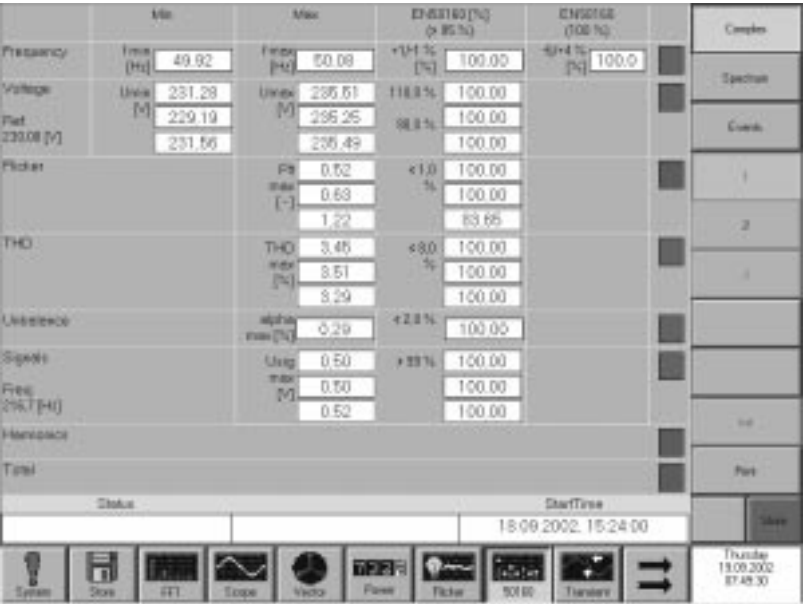


Figure 10.25: Option 50160


²³ Text passages from the Standard that are quoted literally are italicised; see [1]

Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option **[50160]**.


Lower button panel:



The lower button panel of the window shows the **Module-Options-Panel**, which permits changing/selection of other options (all options run parallel). By pressing the button  further options become available. Here the option **[50160]** is selected and appears therefore in the pressed position.



Note: All buttons²⁴ are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

Note: The evaluation criteria (threshold settings) which are used in this measurement option are defined prior to beginning measurement: see section 9, page 56

	Min	Max	EN50160 [%] (> 95 %)	EN50160 (100 %)	
Frequency	f min [Hz] 49.92	f max [Hz] 50.08	+1/-1 % [%] 100.00	-6/+4 % [%] 100.0	

In this display, all relevant values of the EN 50160 analysis are listed (for further details, see section 10.7.1.2.1, **[Complex]** button).

²⁴ If the appropriate modules are licensed

-  (green) These control fields make it possible for the user to receive a quick overview of the fulfillment of the EN 50160 criteria.
-  (red) The following applies to the green field:
The value lies within the EN 50160 limits.
- The following applies to the red field:
The value lies outside the EN 50160 limits.

(for further details, see section 10.7.1.2.1, [**Complex**] button).

Status	StartTime
Voltages Out of Range	10/12/2002, 10:57:01

Under the matrix display of the 50160 analysis, there is a **control and information display** (for further details, see section 10.7.1.2.1 [**Complex**] button).

10.7.1.1 Options and functions in detail

Complex analysis is possible with the 50160 Module according to EN 50160. The following analysis is performed and the results are represented *graphically* and/or *numerically*.

Analysis parameter	Remarks
Frequency	<p>The following values are displayed <i>numerically</i>:</p> <ul style="list-style-type: none"> Minimum frequency (f_{\min}) Maximum frequency (f_{\max}) <p>The following is performed</p> <ul style="list-style-type: none"> the analysis according to EN 50160 (> 95%), as well as the analysis EN 50160 (100%).

Voltage	<p>The following values are displayed <i>numerically</i> for each individual phase:</p> <ul style="list-style-type: none"> ▪ Minimum measurement voltage (U_{\min}) ▪ Maximum measurement voltage (U_{\max}) <p>The following is performed</p> <ul style="list-style-type: none"> ▪ the analysis according to EN 50160 (> 95%), as well as ▪ the analysis EN 50160 (100%). ▪ <p>The voltage levels are generally expressed as average values over a storing period of 200ms –RMS-values.</p> <p>The detection and display of voltage - Events (Dips, interruptions, swells) with following parameters:</p> <ul style="list-style-type: none"> ▪ Date and Time of the event ▪ phase, on which the event occurred ▪ Extrema in [V] ▪ Duration in [s] ▪ Classification in Extrema-value and duration <p>The detection and display of Rapid Voltage Changes (RVC) with following parameters:</p> <ul style="list-style-type: none"> ▪ Date and Time of the RVC ▪ phase, on which the RVC occurred ▪ dmax in [%] ▪ dc in [%] ▪ Duration in [s] ▪ Classification in dc-value and duration
Flicker	<p>The following value is generally displayed <i>numerically</i> for each individual phase:</p> <ul style="list-style-type: none"> ▪ Long-term flicker strength P_{ltmax} <p>The following is performed:</p> <ul style="list-style-type: none"> ▪ the analysis according to EN 50160 (> 95%)
THD and harmonics	<p>The following values are displayed <i>numerically</i> for each individual phase:</p> <ul style="list-style-type: none"> ▪ Maximum total harmonic content THD_{\max} in [%] <p>The following is performed:</p> <ul style="list-style-type: none"> ▪ the analysis according to EN 50160 (> 95%)

	Additionally an exact <i>graphical</i> analysis of the individual harmonics (harmonics value) is possible.
Voltage unbalance	<p>The following values are displayed <i>numerically</i>:</p> <ul style="list-style-type: none"> ▪ α_{\max} in [%] <p>The following is performed:</p> <ul style="list-style-type: none"> ▪ the analysis according to EN 50160 (> 95%)
Signal voltages, ripple control signals	<p>The following values are displayed <i>numerically</i> for each individual phase:</p> <ul style="list-style-type: none"> ▪ Maximum signal voltage (U_{sigmax}) <p>The following is performed:</p> <ul style="list-style-type: none"> ▪ the analysis according to EN 50160 (> 99%) <p>The voltage levels are generally expressed as r.m.s. values</p>
Note:	The meaning of the indicated values of some parameters depends upon the selected circuit diagram (see section 9.2, page 51).

10.7.1.2 Right button panel: menu buttons and their functions

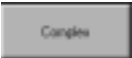
10.7.1.2.1 Overview

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RVC Eval	... Page 148

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	2	
	3	
Init		... Page 149
Print		... Page 149
Store	Store (green)	... Page 149

10.7.1.2.2 Detail

After pressing the button **[Complex]** a display appears which gives a quick overview of the different limits of the relevant parameters for evaluation according to the Standard EN 50160, (their exceeding and/or fulfillment). The following screen appears:



	Min	Max	EN50160 [%] (0-95%)	EN50160 (100%)	
Frequency	Value [Hz] 49.92	Value [Hz] 50.08	+1% [%]	100.00	
Voltage	Value [V] 231.28	Value 235.51	+11.8%	100.00	
Pos. 230.00 [V]	229.19	235.25	99.8%	100.00	
	231.68	235.49		100.00	
Flicker		Pst max [-]	< 1.8 %	100.00	
				100.00	
				85.65	
THD		THD max [%]	+6.8 %	100.00	
				100.00	
				100.00	
Unbalance		alpha max [%]	+2.8 %	100.00	
Signal		Usage [%]	+99 %	100.00	
Freq. 214.7 [Hz]				100.00	
				100.00	
Harmonics					
Total					
Status	Start Time 18.09.2002, 15:24:00				

Figure 10.26: Display after pressing the button **[Complex]**

Note: The buttons **[1]** **[2]** **[3]** of the menu cannot be activated with the **[Complex]** button activated and are therefore represented with a gray background.

The representation of the parameters and their limits is in matrix form. The individual parameters relevant to the EN 50160 analysis are specified among the lines of the matrix. The Min-, Max- and threshold values are listed adjacent to each other in columns of the matrix.

	Min	Max	EN50160 (> 95 %)	EN50160 (100 %)	
Frequency	f _{min} [Hz] 49.92	f _{max} [Hz] 50.08	+1/-1 % [%] 100.00	-5/+4 % [%] 100.0	

Figure 10.27: Example matrix display Frequency

serves as an example of the parameter frequency.

Min: shows the minimum value f_{\min} of the frequency measured since the last initialization (see button [\[Init\]](#) page 149).

Max: shows the maximum value f_{\max} of the frequency measured since the last initialization (see button [\[Init\]](#) page 149).

EN50160(>95%): To meet the standard according to EN 50160, the 10-second average values of the fundamental frequency during 95% of one week must be within the range 50 Hz \pm 1% (i.e. 49,5 to 50,5 Hz) (this regulation applies only to networks with a connection to a interconnected grid system). This part of the array displays the current percentage of the current measurement, in which the frequency has been within the range.

EN50160(>100%): To meet the standard according to EN 50160, the 10-second average values of the fundamental frequency during 100% of one week must lie within the range 50 Hz \pm 4% / -6% (i.e. 47 to 52 Hz) (this regulation applies only to networks with a connection to a interconnected grid system).). This part of the array displays the current percentage of the current measurement, in which the frequency has been within the range.

Voltage	U _{ref} [kV] 35.181	U _{max} [kV] 36.000	110.0 %	100.00	110.0 %	100.00	
R _{ref} 35.180 [kV]	35.139	36.042	80.0 %	100.00	80.0 %	100.00	
	35.285	36.171		100.00		100.00	

Figure 10.28: Example matrix display Voltage

In Figure 10.28: Example matrix display Voltage

the voltage range serves as an example of the description the matrix display. The value of the reference voltage is shown under the word "Voltage" (for setting the reference level, refer MOP ²⁵ [\[System\]](#) → AP²⁶ [\[Setup\]](#) → [\[EN50160\]](#)). The

²⁵ **Module-Options-Panel**

²⁶ **Actions-Panel**

values of the phases are indicated by different colors. The following color code applies:



Phase 1 = red

Phase 2 = blue

Phase 3 = green

Min: shows the minimum value U_{\min} , which means minimum value of all 10 minute-average-RMS-values of the voltage measured since the last initialization (see button [\[Init\]](#) page 149).

Max: shows the maximum value U_{\max} , which means maximum value of all 10 minute-average-RMS-values of the voltage measured since the last initialization (see button [\[Init\]](#) page 149).

EN50160(>95%): To meet the standard according to EN 50160, the 10-minute average values of the r.m.s. values of the supply voltage during 95% of a week-long interval must lie within the range $\pm 10\%$. This part of the array displays the current percentage of the current measurement, in which the voltage RMS-10minutes-average values have been within the range.

EN50160(>100%): To meet the standard according to EN 50160, the 10-minute average values of the r.m.s. values of the supply voltage during 100% of a week-long interval must be within the range $+ 10\%$ and $- 15\%$. This part of the array displays the current percentage of the current measurement, in which the voltage RMS-10minutes-average values have been within the range.

The following applies for further displays in the column **EN50160(>95%)**:

Flicker: To meet the standard according to EN 50160, the long-term flicker strength, P_{lt} , may not exceed the value 1 during 95% of any week-long period. This part of the array displays the current percentage in which the long-term flicker strength has not exceeded the value 1.

THD (total harmonic distortion): To meet the standard according to EN 50160, the total harmonic distortion, THD, of the supply voltage may not exceed the value 8% during 95% of the time. This part of the array displays the current percentage in which the value 8% has not exceeded.

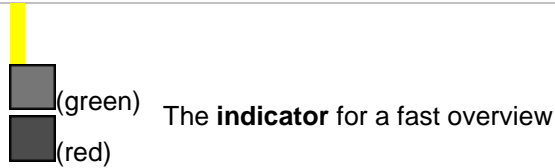
Unbalance: To meet the standard according to EN 50160, the 10-minute average value of the r.m.s. values of the negative sequence components must be smaller than 2% of the corresponding positive sequence system components during 95% of each week-long interval. This part of the matrix displays the current percentage in which the standard is met by $<2\%$.

Note: The column Max indicates the value of α_{\max} in [%] for the row Unbalance.

Harmonics: To meet the standard according to EN 50160, 95% of the 10-minute average values of the voltage r.m.s. values of each individual harmonic may not exceed the values shown in EN50160 within any week-long interval. If this standard is met, the indicator for this line is green.

Note: After pressing the button [*Spectrum*], a more precise view of the frequency analysis is available. In particular the red indicator (i.e. EN 50160 criterion is not fulfilled) shows whether or not the result of the frequency analysis is within harmonic levels.

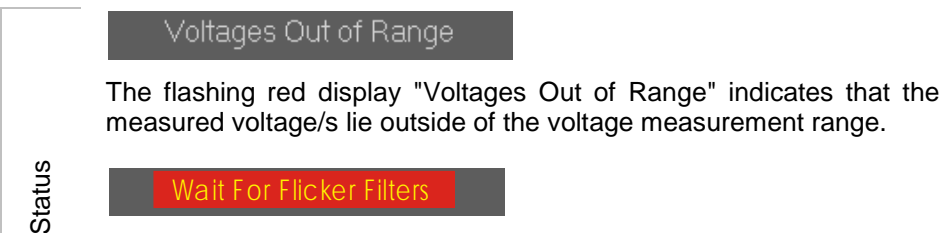
Total result: If all criteria for the fulfillment of the standard according to EN 50160 are met, the appropriate indicator in the row is green.



The indicator makes it possible for the user to receive a quick overview of the fulfillment of the criteria according to EN 50160. If the indicator is **green**, the parameter in the given row lies within the expected range according to EN 50160. If indicator is **red** the parameter does not fulfill the criteria according to EN 50160.

Status	StartTime
Voltages Out of Range	10/12/2002, 10:57:01

The **control and information display** gives information about the status, the reference voltage and the starting time of the measurement.



The flashing red display "Wait For Flicker Filters" at the beginning of the measurement (and after pressing the button **[Init]**) points out that values can only be measured after a few seconds (after initialization and activation of the flicker filter). Once the flicker filter is available, the flashing display disappears.

Start
Time

Indicates the starting time (date and hour) of the measurement. By pressing the button **[Init]**, all array elements are initialized (deleted), the start time display changes to the current date and time and a new measurement begins.

Spectrum

After pressing the button **[Spectrum]** a display of the frequency analysis appears:

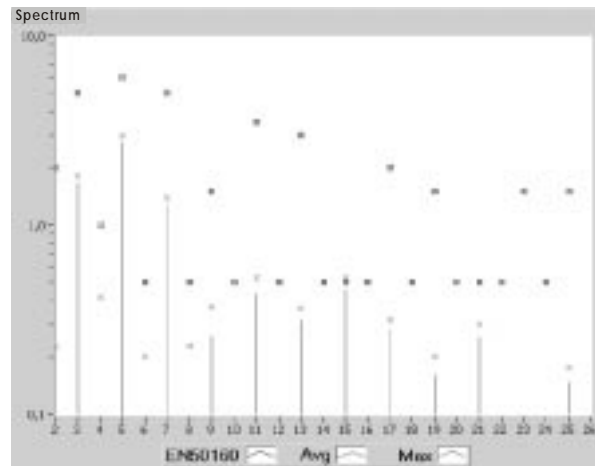



Figure 10.29: Display after pressing the button **[Spectrum]**

The **vertical axis** indicates the percentage of the harmonic voltage by the reference voltage on a logarithmic scale. The **horizontal axis** carries the individual ordinal numbers of the harmonics. The following values and/or limits are marked in the diagram:


EN50160



The blue marking  gives the threshold for the individual harmonic values according to EN 50160

Avg



The green line  indicates the average value of 95% of the "best" values of the measurement time period.



The red cross ✕ marks the maximal measured voltage level over the complete measurement time period.



1
2
3

The phase, which is to be represented, is selected with these buttons.



After pressing the button [Events], the display of tabulated events of the measured voltages appears. The following picture appears:

Fluctuations									
	<2s	<10s	<1s	<30s	<1m	<30m	<1h	>1h	Total
>110,0 %	0	0	0	0	0	0	0	0	0
< 90,0 %	0	0	0	0	0	0	0	0	0
< 75,0 %	0	0	0	0	0	0	0	0	0
< 55,0 %	0	0	0	0	0	0	0	0	0
< 35,0 %	0	0	0	0	0	0	0	0	0
< 15,0 %	0	0	2	4	0	0	0	0	6
Total <	0	0	2	4	0	0	0	0	6
Total >	0	0	0	0	0	0	0	0	0
Total	0	0	2	4	0	0	0	0	6

Events				
Date	Time	Phase	Extrema [V]	Duration [s]
14.03.2012	17:51:35.715	1	0,2	2,53
14.03.2012	17:51:37.494	1	0,2	0,40
14.03.2012	17:42:50.693	2	0,0	06,36
14.03.2012	17:49:50.873	2	182,4	0,91
14.03.2012	17:42:45.081	1	0,3	1,80
14.03.2012	17:49:36.116	2	0,1	0,91
14.03.2012	17:42:27.186	1	0,3	1,94
14.03.2012	17:49:30.086	2	173,4	0,91
14.03.2012	17:49:27.686	3	0,1	0,32

Figure 10.30: Display after pressing the button [Events]

In the **upper half of the screen**, the height and duration of the individual voltage fluctuations since the last initialization are displayed in the form of a matrix. The ranges of the residual voltages of the events are defined in the first column and ranges for the duration of the events at the top of each row.

Reference Values:

>110% means the fluctuation had a level of more than 110% of the reference voltage.

<90% means the residual voltage was lower than 90% of the reference voltage.

The equivalent applies to <75%; <55%; <35% and <15%.

The rows Total<, Total> and Total indicate the sums of the different events. For example, Total< shows the summed number of events (fluctuations) that were

<90%, <75%; <55%; <35% and <15% of the reference voltage. Total shows the entire sum of a column (one time interval).

Note: The value limits (>110%, <90%, etc.) can be set under MOP²⁷ [System] → AP²⁸ [Setup] → [EN50160].

Reference time ranges:

The time interval indicates the duration of the fluctuation.

The events lasted

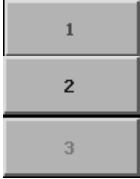
<2p: ...shorter than 2 periods of the reference voltage
<10p: ...shorter than 10 periods of the reference voltage
<1s: ...shorter than 1 second
<10s: ...shorter than 10 seconds
<1m: ...shorter than 1 minute
<10m: ...shorter than 10 minutes
<1h: ...shorter than 1 hour
>1h: ...longer than 1 hour
Total: Indicates the sum of all events in a row (one range of values).

The individual events are tabulated in the **lower half of the screen** with:

- Date (date when the event occurred),
- Time (time-point when the event began, start time),
- Phase (location of the event),
- Extrema (residual voltage in [V]) and
- Duration (time interval),

listed since the last initialization.

Note: events are only registered in the event table and/or event list, if the event is terminated.



With these buttons it is possible to select the phase for which the event table (upper half of screen) is to be presented. The event list's display (lower half of screen) is independent of the choice of phase.

²⁷ **Module-Options-Panel**

²⁸ **Actions-Panel**

After pressing the button [RVC Events], a display of tabulated RVCs (Rapid voltage changes) of the measured voltages is shown. The following picture appears:

RVCH Table (dc/t)						
	<200ms	<500ms	<1s	<5s	>5s	Total
<1%	1	0	0	2	1	4
<2%	0	0	0	0	0	0
<3%	0	0	0	0	0	0
<4%	0	0	0	0	0	0
<5%	0	0	0	0	0	0
<6%	0	0	0	0	0	0
<7%	0	0	0	0	0	0
<8%	0	0	0	0	0	0
<9%	0	0	0	0	0	0
>9%	0	0	0	0	0	0
Total	1	0	0	2	1	4

RVCH Events					
Date	Time	Phase	dcval [%]	dc(t) [%]	Duration [s]
07.05.2004	13:07:49.000	1	1.20	0.00	0.00
07.05.2004	13:07:49.750	1	0.99	0.00	0.75
07.05.2004	13:07:50.000	1	1.24	0.00	0.00
07.05.2004	13:07:52.000	1	1.20	0.00	0.00

Figure 10.31: Display after pressing the button [RVC Events]

In the **upper half of the screen** ("RVCH Table (dc/t)"), the dc-value (relative steady-state voltage change) and the duration of the RVC since the last initialization are displayed in the form of a matrix. The ranges of dc of the RVCs are defined in the first column and ranges for the duration of the RVCs at the top of each column.

Reference dc -values:

<1% means the difference between the initial steady-state voltage and the steady-state voltage at the end of the RVC is less than 1% of the initial one (relative steady-state voltage change $dc < 1\%$)

The equivalent applies to <2%; <3%; <4% and <9%.

> 9% means that the dc value is between 9% and 19,99% (otherwise it must be a dip).

The row/column Total indicates the sums of the different RVCs of the appropriate column/row.

Note:

Limits for the detection algorithm of RVCs can be set under MOP²⁹ [System] → AP³⁰ [Setup] → [EN50160] → [RVC].

²⁹ Module-Options-Panel

³⁰ Actions-Panel

Reference time ranges:

The time interval indicates the duration of the RVCs.

The RVCs lasted

<200ms: ...shorter than 200ms

<500ms: ...shorter than 500ms

<1s: ...shorter than 1 second

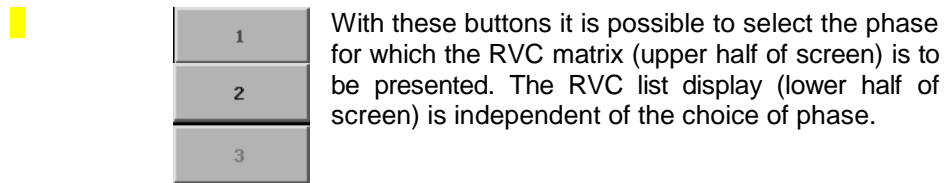
<10s: ...shorter than 10 seconds

>10s: ...longer than 10 seconds

The individual RVCs are listed in the **lower half of the screen** ("RVCH Events") with:

- Date (date when the RVC occurred),
- Time (time-point when the RVC started),
- Phase (location of the RVC),
- dmax [%] (maximum relative voltage change in % U_N)
- dc [%] (relative steady-state voltage change in % U_N)
- Duration (of the RVC),

listed since the last initialization.



After pressing the button [RVC Eval], a display with a statistical evaluation of RVCs according to IEC 61000-3-7 is shown. The following picture appears:

Rapid Voltage Changes					
Changes per hour [p.u.]	dmax [V (u)]	Hours Above Lim./OK	Percentil EE	Actual Time Changes/d/Max	
$x < 1$	$dmax < 3.0$	76.7	8.7	479.9	1.1
$1 < x < 10$	$dmax < 2.5$	8.7	46.7	1771.6	1.2
$10 < x < 100$	$dmax < 1.5$	75.9	26.7	3718.7	1.3
$100 < x < 1000$	$dmax < 1.0$				
$1000 < x$					
dmax [V (u)]	Changes per hour [p.u.]	Hours Above Lim./OK	Percentil EE	Actual Time Changes	
$3.0 < dmax$	$x < 0$	76.7	8.7	0	1.1
		8.7	46.7	1	1.2
		75.9	26.7	2	1.3
$2.5 < dmax < 3.0$	$x < 1$	8.7	100.0	0	1.1
		8.7	100.0	0	1.2
		8.7	100.0	0	1.3
$1.5 < dmax < 2.5$	$x < 10$	8.7	100.0	0	1.1
		8.7	100.0	0	1.2
		8.7	100.0	0	1.3
$1.0 < dmax < 1.5$	$x < 100$	8.7	100.0	1	1.1
		8.7	100.0	0	1.2
		8.7	100.0	0	1.3
$dmax < 1.0$	$x < 1000$	8.7	100.0	0	1.1
		8.7	100.0	0	1.2
		8.7	100.0	0	1.3

Figure 10.32: Display after pressing the button [RVC Eval]

On this display you can see an automatic evaluation of RVCs according to IEC 61000-3-7. The PNA collects all occurring RVCs every hour and evaluates them afterwards.

Upper table:

The column "Actual hour" shows the number of RVCs ("Rapid voltage changes") and the maximum dmax ("dmax"), which occurred during the running evaluation-hour, sorted by phases.

After one full hour PNA-software evaluates all these RVCs according to the limits, described in the columns "dmax" and "changes per hour".

The column "Hours" shows the amount of evaluated hours, in which the RVCs were inside the limits ("OK") and the number of evaluated hours, in which the RVCs exceeded the limits ("Above Lim.").

The column "percentil" shows the percentage of the evaluated hours, in which the RVCs were inside the limits ("OK").

Lower table:

In addition to the information described for the upper table, the evaluation display classifies the informations in several dmax-value-parts.



By pressing the button **[Init]** all current values in the display (and measurement values to this point) are deleted and a new measurement procedure is initialized (started).

Note:

The button **[Init]** is not available in the active memory mode (i.e. button **[Store]** is green). An initialization can only be done if the memory procedure is terminated prior to this (see also section 9.3).



By pressing the button **[Print]** the „Print Panel“ appears. Within this panel it is possible to print the current display and/or save it as a BMP-file. More about this button, see page 105.




(gray)



(green)



This button cannot be activated. It serves only as information about whether data recording is taking place or not.

Data recording is taking place, if this button is green. Data recording is activated, but there has not been any recording yet, when the button is yellow. To change to the module for data recording is possible at any time by pressing the button 

[Store] in the Module-Options-Panel.

10.8 Transient Recorder

10.8.1 Start screen

The C.A 8352 is a high performance power quality analyzer, which makes all measurements and analysis available simultaneously and in their entirety. If the equipment settings (see section 9) have been selected and all measurement connections have been connected, measurement can be started by pressing the button  [*Start Meas*]. The Option TRANSIENT is available after pressing the button  [*Transient*]. The following display appears on the screen:

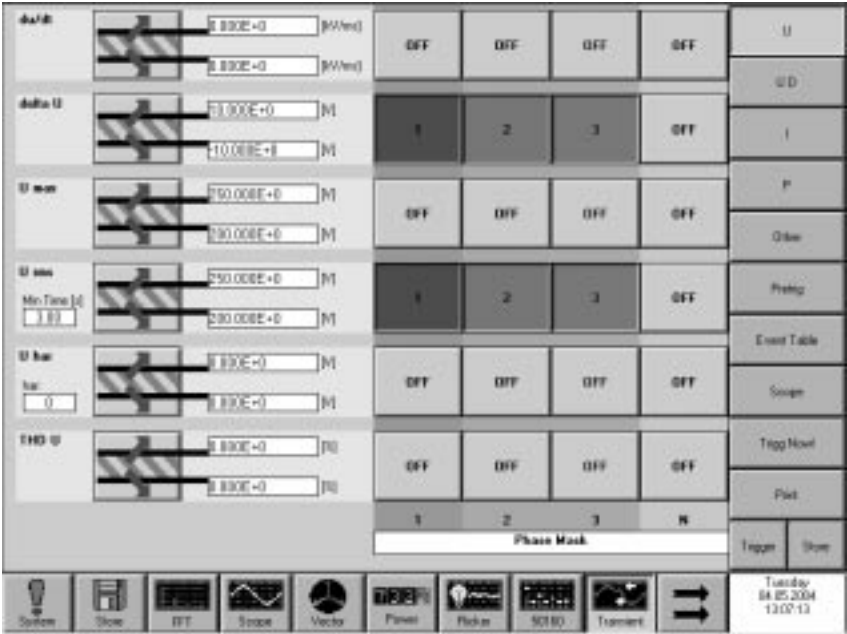


Figure 10.33: Option TRANSIENT


Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option [*Transient*].



Lower button panel:



The lower button panel of the window shows the **Module-Options-Panel**, which permits changing/selection of other options (all options run parallel). By pressing the button  further options become available. Here the option [*Transient*] is selected and appears therefore in the pressed position.

Note:

All buttons³¹ are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

10.8.2 Options and functions in detail

The following measurements are possible with the Transient module:

Recognizing, saving, listing and temporally representing of user-defined events.

Technical specifications:

maximum sampling rate in [Hz]:	38400 Hz (with 1-phase measurement) 19200 Hz (with 3-phase-measurement) 9600 Hz (with 4-phase measurement)
maximum number of samples able to be saved per event:	61440 (corresponding to a recording of 6,4 s with 1-phase measurement)




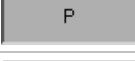




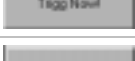

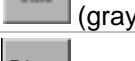
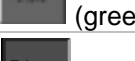
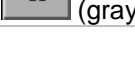
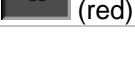
³¹ If the appropriate modules are licensed

Note:

The meaning of the indicated values of some parameters depends upon the selected circuit diagram (see section 9.2, page 51).

10.8.3 Right button panel: menu buttons and their functions

10.8.3.1 Overview

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	... Page 164
	... Page 165
	... Page 166
 (gray)  (green)	... Page 166
 (gray)  (red)	... Page 166

10.8.3.2 Detail



Pressing the button [U] changes the screen to a display of the criteria able to be selected for voltage events.

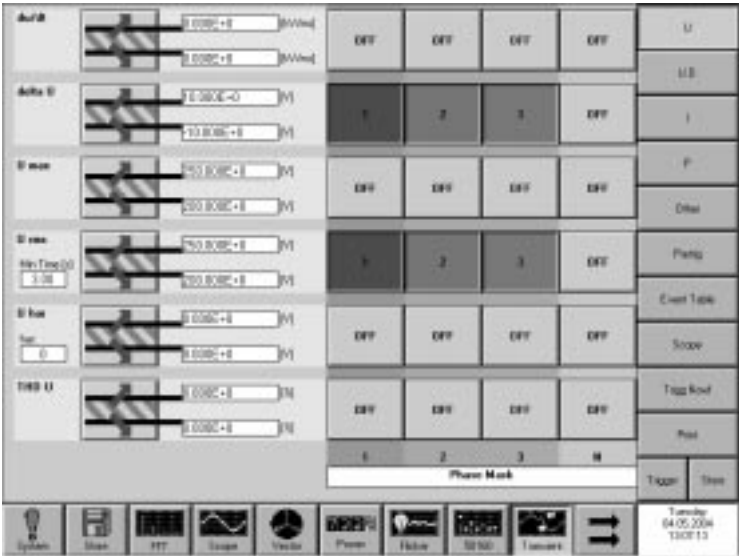


Figure 10.34: Display after pressing the button [U]

Criteria able to be selected for voltage events:



temporal increase in voltage in [kV/ms]



changes in 10ms RMS value of the voltage in [V]



maximum value of the voltage in [V]



10ms RMS value of the voltage in [V];
with “Min Time [s]” you can enter a minimum duration, for which the

set limits must be exceeded to start the transient recording

r.m.s. value of the harmonic component of the voltage in [V], which is to be set in the field

har:



total harmonic distortion (THD factor) of the voltage in [%]

You will find a detailed description of the selection procedure on page 159.



Pressing the button **[UD]** changes the screen to a display of the criterias, which can be selected for trigger events of the calculated line-to-line voltages.

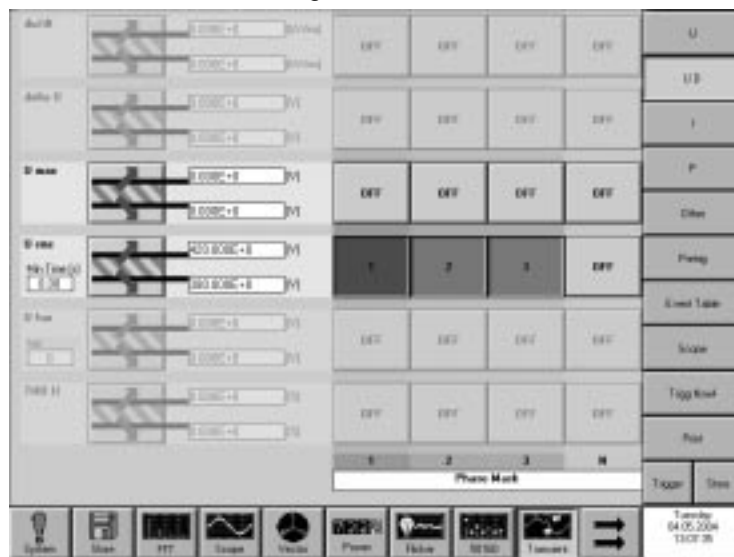


Figure 10.35: Display after pressing the button **[UD]**

Note: The button **[UD]** is only selectable, if you use connection diagram 7 (3xUph + 3xIph Y/D) or connection diagram 8 (3xUph + 3xIph Y/D + M), see page 46, because only with these connection diagrams line-to-line voltages are calculated from measured line-to-earth voltages.

Criteria, which can be set for the calculated line-to-line voltages:



maximum value of the voltage in [V]



10ms RMS value of the voltage in [V]; with “Min Time [s]” you can enter a minimum duration, for which the set limits must be exceeded to start the transient recording

You will find a detailed description of the selection procedure on page 159.



Pressing the button [I] changes the screen to a display of the criteria able to be selected for current events.

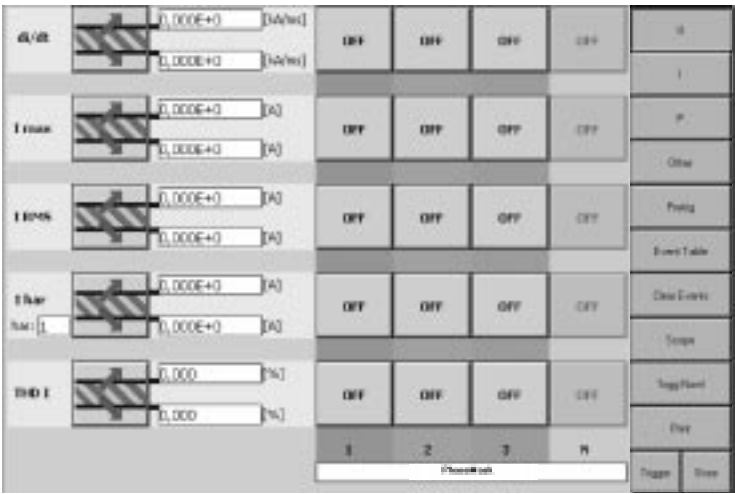


Figure 10.36: Display after pressing the button [I]



temporal increase in current in [kA/ms]



changes in 10ms RMS value of the current in [A]



maximum value of the current in [A]



10ms RMS value of the current in [A]; with “Min Time [s]” you can enter a minimum duration, for which the set limits must be exceeded to start the transient recording



r.m.s. value of the harmonic component of the current in [A], which is to be set in the field

har:



total harmonic distortion (THD factor) of the current in [%]

You will find a detailed description of the selection procedure on page 159.

P

Pressing the button [**P**] changes the screen to a display of the criteria able to be selected for power events.

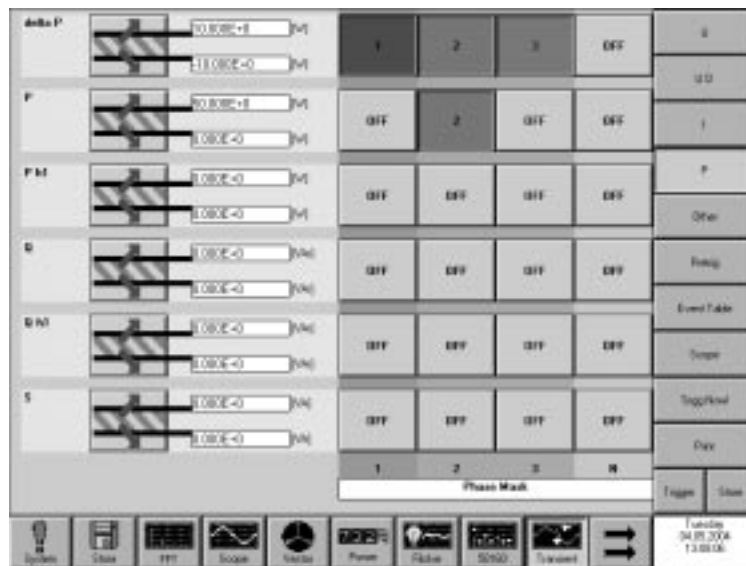


Figure 10.37: Display after pressing the button [P]

Criteria able to be selected for power events:

Active P	<input type="text" value="1.000E+0 [W]"/> <input type="text" value="1.000E+0 [W]"/>	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> OFF	changes in active power in [W]
P	<input type="text" value="0.000E+0 [W]"/> <input type="text" value="0.000E+0 [W]"/>	<input type="checkbox"/> OFF <input type="checkbox"/> OFF <input type="checkbox"/> OFF <input type="checkbox"/> OFF	active power in [W]
P1	<input type="text" value="0.000E+0 [W]"/> <input type="text" value="0.000E+0 [W]"/>	<input type="checkbox"/> OFF <input type="checkbox"/> OFF <input type="checkbox"/> OFF <input type="checkbox"/> OFF	active power of the fundamental frequency in [W]
Q	<input type="text" value="0.000E+0 [Var]"/> <input type="text" value="0.000E+0 [Var]"/>	<input type="checkbox"/> OFF <input type="checkbox"/> OFF <input type="checkbox"/> OFF <input type="checkbox"/> OFF	reactive power in [Var]
Q1	<input type="text" value="0.000E+0 [Var]"/> <input type="text" value="0.000E+0 [Var]"/>	<input type="checkbox"/> OFF <input type="checkbox"/> OFF <input type="checkbox"/> OFF <input type="checkbox"/> OFF	reactive power of the fundamental frequency in [Var]



apparent power in [VA]

You will find a detailed description of the selection procedure on page 159.



Pressing the button **[Other]** changes the screen to a display of the criteria able to be selected for special event criteria.

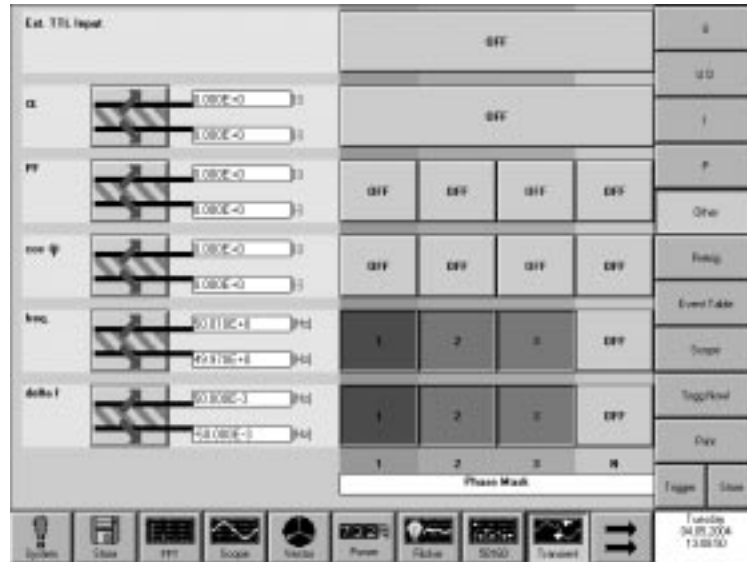


Figure 10.38: Display after pressing the button **[Other]**

Criteria able to be selected:








This button activates/deactivates the possibility to trigger a transient recording via a connected external TTL input signal




By pressing the button **[OFF]** the designation of the button changes to **[ON]**.

Unbalance factor of the 3-phase voltage α_U in [%]

CE		0.000E+0 H 0.000E+0 H	ON	
PF		0.000E+0 H 0.000E+0 H	OFF OFF OFF OFF	Power factor of the complete signal
cos φ		0.000E+0 H 0.000E+0 H	OFF OFF OFF OFF	cosPhi (power factor of the fundamental frequency)
freq		0.000E+0 Hz 0.000E+0 Hz	1 2 3 OFF	frequency in [Hz]
delta f		0.000E+0 Hz 0.000E+0 Hz	1 2 3 OFF Phase Mask	frequency change in [Hz]

You will find a detailed description of the selection procedure on page 159.


Explanation of the selection procedure:





0.000E+0


0.000E+0

An event is detected if the measurement variable is outside the range enclosed by the selected high value (upper field) and the selected low value (lower field).



The input of the high value (upper field) and/or low value (lower field) takes place via clicking on the appropriate field and associated activation of the keypad window:

By pressing the button  the display of the button changes to  and activates the following selection option:



0.000E+0

0.000E+0

An event is detected if the measurement variable is inside the range enclosed by the selected high value (upper field) and the selected low value (lower field).




The input of the high value (upper field) and/or low value (lower field) takes place via clicking on the appropriate field and associated activation of the keypad window:

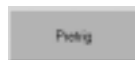
Note: This keypad offers the possibility of entering the values +infinity („+∞“) and -infinity („-∞“).



e.g.:



By pressing one of the  buttons, the connected phases, which are to be monitored regarding the pre-defined event, can be selected separately. The buttons then take on the designation and color of the selected phase. If a phase is not connected, it is gray in color.



Pressing the button **[Pretrig]** changes the screen to a display of the some special parameters for the transient recorder function.

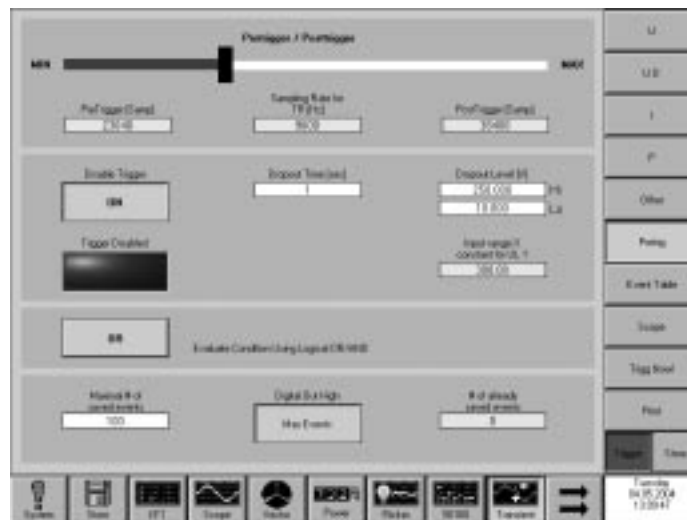
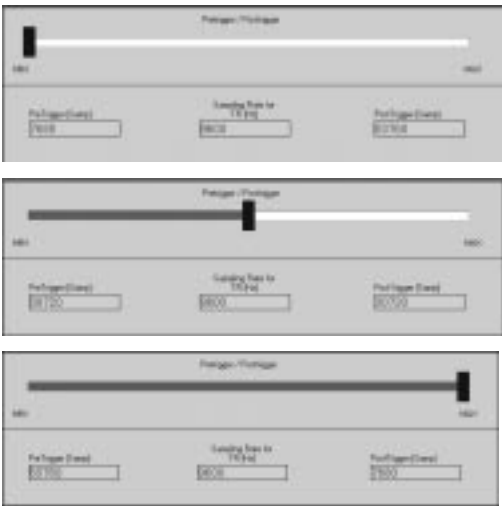


Figure 10.39: Display after pressing the button **[Pretrig]**

Description of the selectable special parameters:



In total **61440 samples** with a **sampling rate of up to 38400 Hz** (with 1-phase measurement) can be stored. A pre-trigger range and a post-trigger range can be selected by shifting the black bar:

Note: These settings can only be changed, if there is no measurement with activated transient storing running.

PreTrigger [Samp]
53760

This field indicates the number of samples that are detected **before** the occurrence of the event. This value changes automatically with the movement of the black bar.

Sampling Rate for TR [Hz]
9600

In this field the **sampling rate of the transient recorder** (number of signal samplings performed per second) is displayed. With 1-phase measurement it is possible to have a maximum scanning rate of 38400 Hz, with 3-phase measurement a maximum scanning rate of 19200 Hz, and with 4-phase measurement a maximum scanning rate of 9600 Hz. The input is made by clicking on the field and marking the desired value in the displayed list.



PostTrigger [Samp]
7680

This field indicates the number of samples that are detected **after** the occurrence of the event. This value changes automatically with the movement of the black bar.



Within this range, a special trigger suppression can be activated and /or deactivated:

For example: If the decrease of a parameter below a certain threshold value is defined as a trigger characteristic (e.g. threshold value for voltage r.m.s. value is 200V) and there is a long, persisting total failure of this parameter (e.g. a voltage interruption for some seconds), the transient recorder triggers continuously with storing always the same information.
In order to prevent such an incident, it is possible to deactivate the trigger automatically, when the voltage of the triggered phase falls below the **Dropout Level Lo in [V]** or rises above the **Dropout Level Hi in [V]** for a duration longer than the time specified in **Dropout Time in [sec]**.

This special trigger suppression is activated by pressing the  button and deactivated by pressing the  button.

Dropout Time [sec]

1

minimum duration of the Dropout Level exceedings

Dropout Level [V]

250.000

Hi

10.000

Lo


Dropout Level Hi for the upper threshold and Dropout Level Lo for the lower threshold, which start the trigger suppression, when exceeded.

Input range X
constant for UL 1

300.00

This field serves purely as an information field for the selected measurement range end value for the r.m.s. values of the voltage of phase 1 in the module **[System]**.

Trigger Disabled



This field indicates by its red color whether a voltage failure (defined above) takes place and thus triggering is deactivated.

OR

Evaluate Condition Using Logical (OR) AND

(„OR“-link)

With the selection of **[OR]**, an event is detected as soon as **one** of the selected event criterias occurs.

By pressing the button **[OR]** the designation of the button changes to **[AND]**.

AND

Evaluate Condition Using Logical (OR) AND

(„AND“-link)

With the selection of **[AND]** an event is detected only if **all** selected event criteria occur simultaneously.



In this field, the maximum number of trigger events, which can be saved, can be defined and the number of already stored transients is shown. Additionally the functionality of the HW-digital-out-signal can be set.

Maximal # of saved events
100

Enter the maximum number of transients, which are allowed to be stored by the software.



With this button the HW-digital-out-signal can be activated. There are two possibilities to get the HW-digital-out HIGH:

If the **"Trigg Status"** characters are present each transient recording causes a HW-digital-out HIGH.

Are the **"Max Events"** characters present the HW-digital-out is set to HIGH by reaching the maximum number of events, which are allowed to be stored.

of already saved events
0

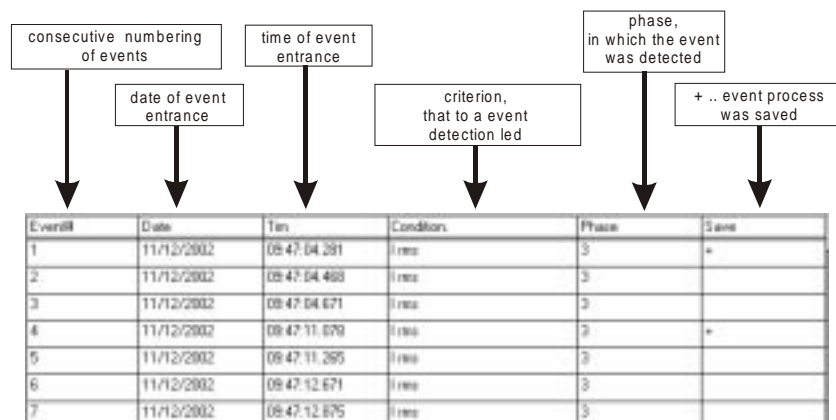
This field shows the number of already stored transients.

Pressing the button **[Event Table]** changes the display to a tabular representation of the detected events.

Case#	Age	Sex	Location	Phase	Time		
1	15/12/2002	00:47:04.00	2 min	3	→		0
2	15/12/2002	00:47:04.00	2 min	3			1
3	15/12/2002	00:47:04.01	2 min	3			
4	15/12/2002	00:47:05.00	2 min	3	→		
5	15/12/2002	00:47:05.05	2 min	3			2
6	15/12/2002	00:47:05.07	2 min	3			
7	15/12/2002	00:47:05.07	2 min	3			Blue
8	15/12/2002	00:47:05.07	2 min	3			Phase
9	15/12/2002	00:47:05.08	2 min	3			Event Table
10	15/12/2002	00:47:06.00	2 min	3	→		Get Events
11	15/12/2002	00:47:08.00	2 min	3			Scope
12	15/12/2002	00:47:08.00	2 min	3			Taglist
							Plot
							Page
							Size

Figure 10.40: Display after pressing the button [Event Table]

Tabular representation in overview:



Clear Earnings

Pressing the button [*Clear Events*] just clears the list, but does not really delete the stored transients.



Pressing the button [**Scope**] shows voltages and currents of the last detected event (200ms around the trigger point).

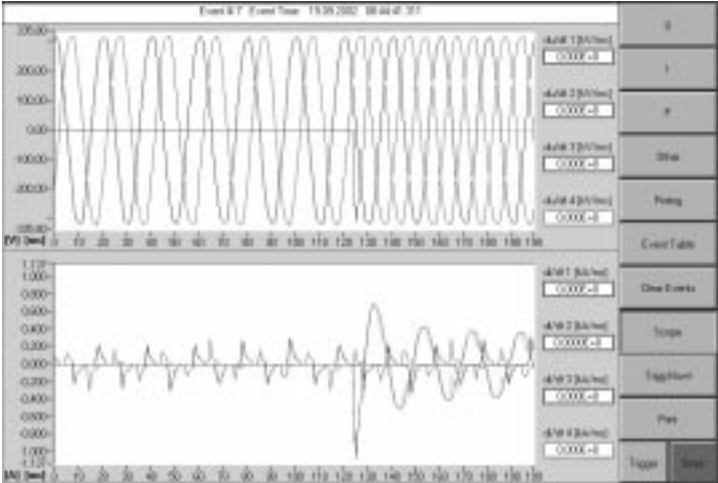
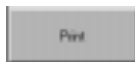


Figure 10.41: Display after pressing the button [**Scope**]

Description of the display areas:

Event # 7 Event Time: 19.09.2002 08:44:31.1	Event number and time of the given event
	Time period of the measured voltages in the time window of 200 ms around the given event: (color coding of the phases: 1...red; 2...blue; 3...green; N...yellow)
	Time period of the measured currents in the time window of 200 ms around the given event: (color coding of the phases: 1...red; 2...blue; 3...green; N...yellow)
	Pressing the button [Trigg Now!] manually triggers recording, i.e. a transient "shot" is recorded.



By pressing the button [*Print*] the „Print Panel“ appears. Within this panel it is possible to print the current display and/or save it as a BMP-file. More about this button, see page 105.




(gray)



(green)

This button cannot be activated. It serves only as information about whether data recording is taking place or not.

Data recording is taking place, if this button is green. Data recording is activated, but there has not been any recording yet, when the button is yellow. To change to the module for data recording is possible at any time by pressing the button 

[*Store*] in the Module-Options-Panel.



(gray)




(red)



This button cannot be activated. It serves only as information about whether a pre-defined event is taking place or not. With the occurrence of the pre-defined event, the color of the button changes to red.

10.9 Ripple control signals, telegrams

(Mains signalling voltage on the supply voltage)

10.9.1 Start screen

The C.A 8352 is a high performance power quality analyzer, which makes all measurements and analysis available simultaneously and in their entirety. If the equipment settings (see section 9) have been selected and all measurement connections have been connected, measurement can be started by pressing the button  [**Start Meas**]. The Option TELEGRAM appears after pressing the

button  and is available after pressing the button  [**Teleg.**]. The following display appears on the screen:

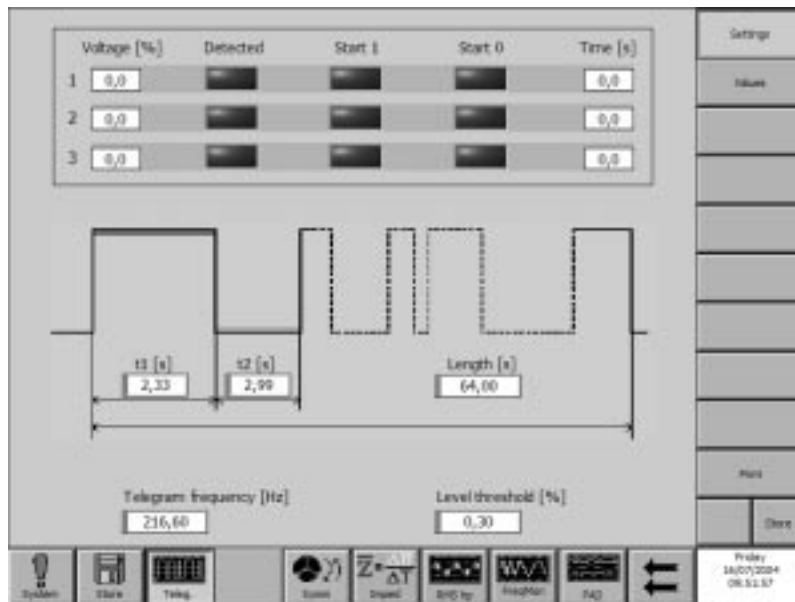


Figure 10.42: Option TELEGRAM


Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option [*Teleg.*].



Lower button panel:



The lower button panel of the window shows the **Module-Options-Panel**, which permits changing/selection of other options (all options run parallel). By pressing the button  further options become available. Here the option [*Teleg.*] is selected and appears therefore in the pressed position.

Note: All buttons³² are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

10.9.2 Options and functions in detail

With the telegram module, it is possible to locate and record telegrams (ripple control signals). A *graphical* display of the packets, which transmit information (telegrams) in the individual phases, is similarly possible.

³² If the appropriate modules are licensed






Analysis parameter	Remarks
ripple control signal	<p>automatic search for telegrams in phases 1, 2, 3 with simultaneous recording. Recording and/or indication is therefore:</p> <ul style="list-style-type: none"> the starting point with date and time (Start) the analysis and/or filter frequency (Freq) Maximum voltage of the received signal (U_{\max}) Maximum current of the received current (I_{\max}) Average voltage level of the received signal (U_{ON}) Average current level of the received signal (I_{ON}) Graphical display of the captured data bit sequence (signals) <p>The voltage and current values generally expressed as R.M.S - values.</p>

Note:

The meaning of the indicated values of some parameters depends upon the selected circuit diagram (see section 9.2, page 51).

10.9.3 Right button panel: menu buttons and their functions

10.9.3.1 Overview

	... Page 170
	... Page 172
	... Page 173
 (gray)  (green)	... Page 173

10.9.3.1.1 Detail

After pressing the button [Settings] selection of the recording signal can be made. The following display appears:

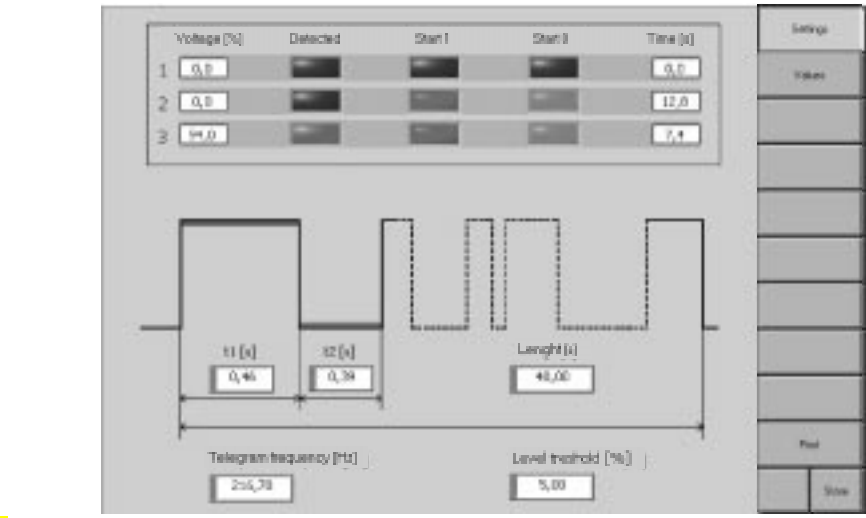


Figure 10.43: Display after pressing the button [Settings]

The window is divided into two areas. In the lower window area, a telegram signal is schematically displayed. By clicking with the mouse on the appropriate input field, the benchmark of the packets for the analysis can be entered.

The input fields thus have the following meanings:

t1 [s] In this input field the length (duration) of the positive start bit, t_1 , in [s] (i.e. "high" condition = Start 1) must be entered.

t2 [s] In the second input field the length (duration) of the negative start bit, t_2 , in [s] (i.e. "low" condition = Start 0) must be entered.

Length [s] Finally the total length (total time), $Length$, of a packet is to be entered in [s].

Telegram frequency [Hz]

216,70

the *Telegram frequency* in [Hz] (i.e. the frequency of the fed telegram signal) and

Level treshold [%]

5,00

the *Level threshold* in [%] of the fundamental frequency (i.e. the signal is only recognized as such starting from this voltage level. If the signal level for example is below the threshold, no telegram signal will be recognized → thus e.g. errors as a result of noise can be suppressed).

The display in the **upper window area** is a control display. It shows whether a telegram is recognized as such and/or that a signal has been captured.










	Voltage [%]	Detected	Start 1	Start 0	Time [s]
1	0,0				0,0
2	0,0				12,8
3	94,0				7,4

Figure 10.44: Control display for the telegram analysis

The column **Voltage [%]** indicates the r.m.s. value level of the voltage³³ of the captured signal regarding the fundamental frequency level.

In the column **Detected** a green field appears as soon as a voltage with the selected analysis frequency is recognized.

If the positive start bit (i.e. "high" condition = **Start 1**), regarding the criteria (i.e. the duration t_1), is confirmed, the field in this column lights up. Then, if the negative start bit (i.e. "low" condition = **Start 0**) is also confirmed, the field similarly lights up in the appropriate column.

Only if both start bits are recognized and confirmed the telegram-recording starts, whose current length (duration) is displayed in the column **time [s]**. The preceding start bits are also recorded.

³³ with the appropriate analysis frequency



After pressing the button [Value] the following display appears:

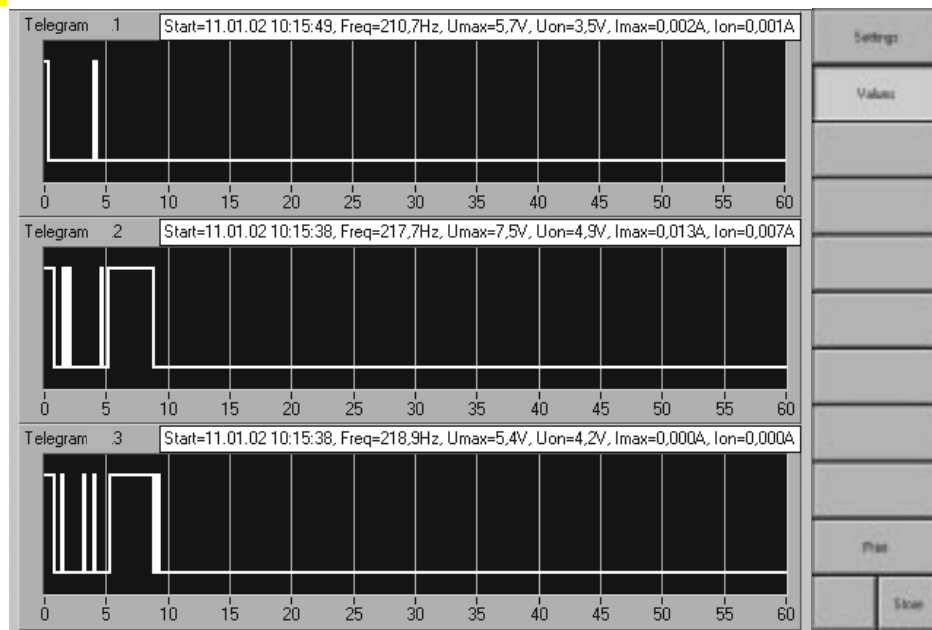


Figure 10.45: Display after pressing the button [Value]

The last captured telegrams of the individual phases are graphically represented. Additionally control values are displayed via individual graphs. The following values are displayed:

- **Start:** Indicates the exact measured frequency of the captured telegram.
- **Freq:** Indicates the exact measured frequency of the captured telegram.
- **Umax:** Indicates the maximum voltage level (r.m.s. value) of the telegram signal, which arose during the captured telegram.
- **Imax:** Indicates the maximum current level (r.m.s. value) of the telegram signal, which arose during the captured telegram.


- **Uon:** Indicates the mean voltage level (r.m.s. value) of logic 1 signals ("high" condition) over the captured Telegram packet (total length) for which the value lies above the response threshold.
-
- **Ion:** Similarly applies to the current.
-

Note: A graphical view of previously captured signals is only possible in the program „C.A 8352-Post“(see section 11).






By pressing the button [**Print**] the „Print Panel“ appears. Within this panel it is possible to print the current display and/or save it as a BMP-file. More about this button, see page 105.



This button cannot be activated. It serves only as information about whether data recording is taking place or not. Data recording is taking place, if this button is green. Data recording is activated, but there has not been any recording yet, when the button is yellow. To change to the module for data recording is possible at any time by pressing the button  [**Store**] in the Module-Options-Panel.

10.10 Unbalance analysis

10.10.1 Start screen

The C.A 8352 is a high performance power quality analyzer, which makes all measurements and analysis available simultaneously and in their entirety. If the equipment settings (see section 9) have been selected and all measurement connections have been connected, measurement can be started by pressing the button  [*Start Meas*]. The Option SYMMETRY appears after pressing the button  and is available after pressing the button  [*Symm*]. The following display appears on the screen:

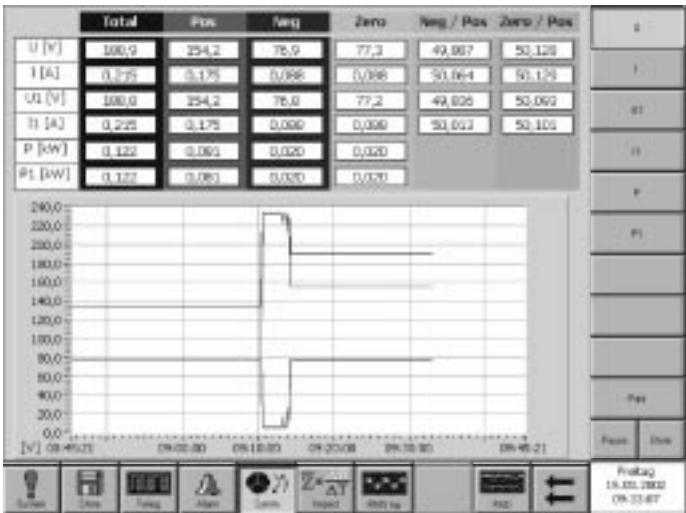


Figure 10.46: Option SYMMETRY


Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option [*Symm*].



Lower button panel:



The lower button panel of the window shows the **Module-Options-Panel**, which permits changing/selection of other options (all options run parallel). By pressing the button  further options become available. Here the option [*Symm*] is selected and appears therefore in the pressed position.

Note: All buttons ³⁴ are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

³⁴ If the appropriate modules are licensed

10.10.1.1 Options and functions in detail

The [**Symm**] - Module serves its purpose only with measurement in a three-phase power supply (not with single-phase measurement). Under this condition the following measurements are possible:

Functions/Options	Remarks
U in [kV]	<i>voltage r.m.s. values:</i> 3-phase, positive-, negative-, zero-phase sequence system
I in [A]	<i>current r.m.s. values:</i> 3-phase, positive-, negative-, zero-phase sequence system
U1 in [kV]	<i>voltage r.m.s. values of the fundamental harmonic:</i> 3-phase, positive-, negative-, zero-phase sequence system
I1 in [A]	<i>current r.m.s. values of the fundamental harmonic:</i> 3-phase, positive-, negative-, zero-phase sequence system
P in [kW]	<i>active power:</i> 3-phase, positive-, negative-, zero-phase sequence system
P1 in [kW]	<i>active power of the fundamental harmonic:</i> 3-phase, positive-, negative-, zero-phase sequence system
NEG/POS in [%]	<i>ratio negative-/positive-components in [%]</i> <i>(corresponds the unbalanced factor α_U of U, U1 and unbalanced factor α_I of I, I1)</i>
ZERO/POS in [%]	<i>ratio zero-/positive-components in [%] of U, U1, I, I1</i>

Note:

The meaning of the indicated values of some parameters depends upon the selected circuit diagram (see section 9.2, page 51).

10.10.2 Right button panel: menu buttons and their functions

Note:

All buttons are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

10.10.2.1.1 Overview

U	...	Page 178
U1	...	Page 178
I	...	Page 178
I1	...	Page 178
P	...	Page 179
P1	...	Page 179
Pint	...	Page 179
Store (gray)	Store (green)	...
		Page 179

10.10.2.1.2 Detail

Overview of tabular display

displayed parameter	symmetrical	positive-phase sequence system	negative-phase sequence system	zero-phase sequence system	negative-/positive-system	zero-/positive-system
	Total	Pos	Neg	Zero	Neg/Pos	Zero/Pos
U [kV]	0.0008	0.0001	0.0001	0.0008	99.675	1164.004
I [A]	16.9	3.0	3.0	16.4	99.992	549.241
U1 [kV]	0.0000	0.0000	0.0000	0.0000	98.376	57.375
I1 [A]	0.6	0.1	0.1	0.5	96.066	398.985
P [kW]	0.039	0.001	0.001	-0.040		
P1 [kW]	0.000	0.000	0.000	0.000		

Figure 10.47: Tabular Display

The meaning of the displayed parameters is described in section 10.10.1.1 "Options and functions in detail". If due to the type of switch selection (e.g. with single-phase measurement) no partitioning is possible into symmetrical components, the value 0 is displayed in all fields.

Time representation

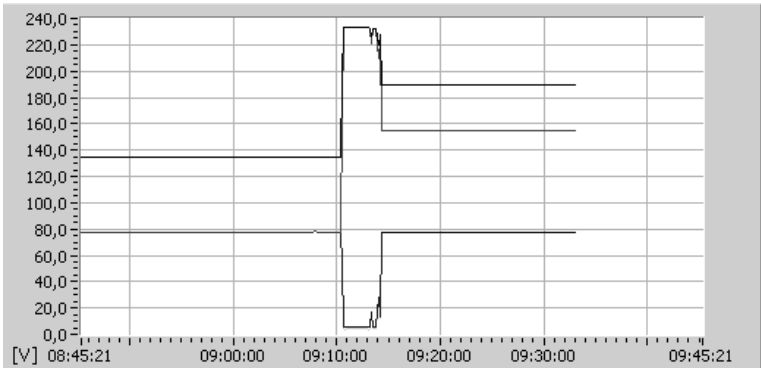








Figure 10.48: Time representation

This represents the course of positive, negative and zero-phase sequence systems over time and their respective symmetrical values for the parameter selected in the menu i.e.:

Pressed button in the AP ³⁵	Representation of the course of positive , negative and zero -phase sequence systems over time and their symmetrical values (line colors correspond to the colors from the tabular representation)
	the r.m.s. values of the total voltage
	the r.m.s. values of the fundamental frequency voltage
	the r.m.s. values of the total current
	the r.m.s. values of the fundamental frequency current

³⁵ Action-Panel

	the total active power
	the total active power of the fundamental frequency

Note:

Pressing one of the buttons of the menu does not change anything in the tabular representation lying above it (neither general appearance nor values in the fields)

The **horizontal axis** is the time axis and shows a time window of 1 hour. The scaling of the **vertical axis** of the diagrams occurs dynamically for the appropriate measurement values.



By pressing the button [**Print**] the „Print Panel“ appears. Within this panel it is possible to print the current display and/or save it as a BMP-file. More about this button, see page 105.




(gray)



(green)




This button cannot be activated. It serves only as information about whether data recording is taking place or not.

Data recording is taking place, if this button is green. Data recording is activated, but there has not been any recording yet, when the button is yellow. To change to the module for data recording is possible at any time by pressing the button 

[**Store**] in the Module-Options-Panel.

10.11 Impedance measurement

10.11.1 Start screen

The C.A 8352 is a high performance power quality analyzer, which makes all measurements and analysis available simultaneously and in their entirety. If the equipment settings (see section 9) have been selected and all measurement connections have been connected, measurement can be started by pressing the button  [Start Meas]. The Option IMPEDANCE appears after pressing the button  and is available after pressing the button  [Imped]. The following display appears on the screen:

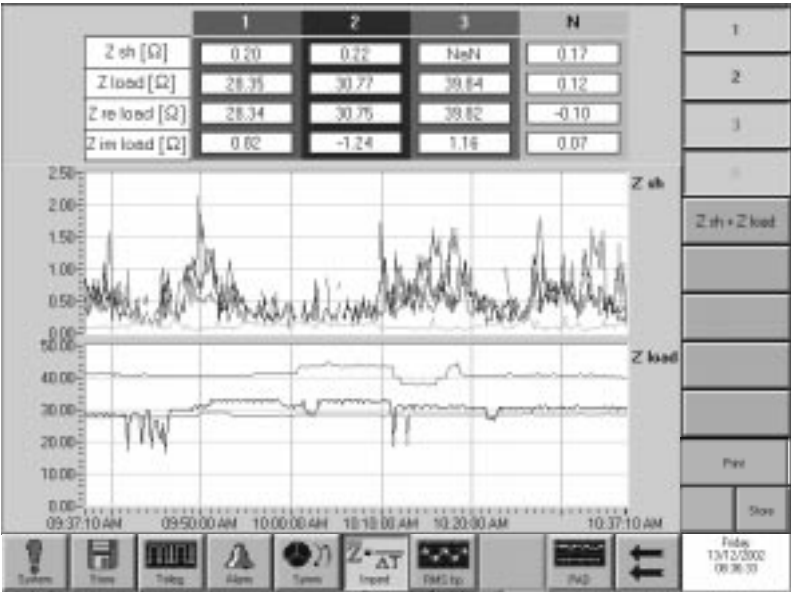


Figure 10.49: Option IMPEDANCE


Right button panel:

The right button panel of the window (called **action-panel**) shows the menu for changing various field settings and other menu buttons within the option [*Imped*].



Lower button panel:



The lower button panel of the window shows the **Module-Options-Panel**, which permits changing/selection of other options (all options run parallel). By pressing the button  further options become available. Here the option [*Imped*] is selected and appears therefore in the pressed position.

Note:

All buttons³⁶ are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

10.11.2 Options and functions in detail

With the impedance module it's possible to determine the network impedances of each phase (see section 10.11).

Note:

Which phase-impedances are displayed depends on the chosen circuit diagram (see section 9.2).

³⁶ If the appropriate modules are licensed

10.11.3 Right button panel: menu buttons and their functions

Note: All buttons are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

10.11.3.1.1 Overview

1

2

3

... Page 183

Z sh + Z load

Z load Cpl

and

... Page 183

Print

... Page 183

Store

Store

(gray) (green)

... Page 183

10.11.3.2 Detail

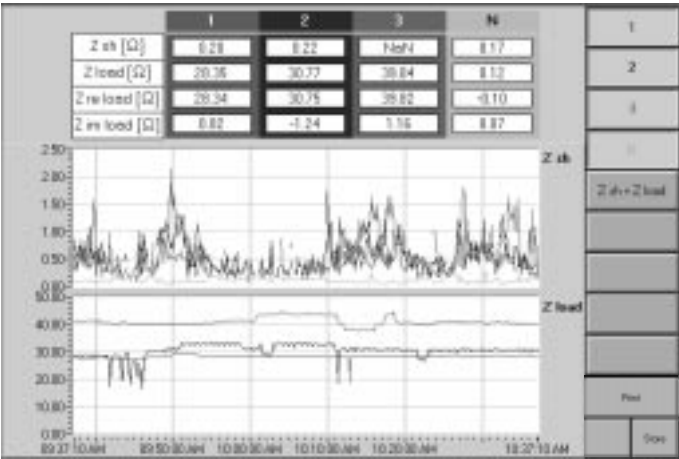


Figure 10.50: Display after pressing the button [Imped]

The **left vertical axis** shows the impedance scale in [Ω].

The **horizontal axis** shows the time axis.



With these buttons, it is possible to switch on/off individual phases. Only activated phases are displayed on the graph.

Which phase-impedances can be displayed depends on the selected circuit diagram and measurement type (see section 9.2).

phase 1 = red
phase 2 = blue
phase 3 = green
neutral conductor = yellow



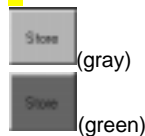
If the button [**Zsh + Zload**] is displayed, the time process of the parameters Zsh (short circuit impedance; net impedance) and Zload (Impedance of the load) is shown in the diagram. If you click on this button, the content of the button changes to...




If the button [**Zload Cplx**] is displayed, the time process of the parameters Zload real part and Zload imaginary part is shown in the diagram. If you click on this button, the content of the button changes back to [**Zsh + Zload**].



By pressing the button [**Print**] the „Print Panel“ appears. Within this panel it is possible to print the current display and/or save it as a BMP-file. More about this button, see page 105.






This button cannot be activated. It serves only as information about whether data recording is taking place or not.

Data recording is taking place, if this button is green. Data recording is activated, but there has not been any recording yet, when the button is yellow. To change to the module for data recording is possible at any time by pressing the button 

[**Store**] in the Module-Options-Panel.

10.12 Half cycle measurement (RMS hp)

10.12.1 Start screen

The C.A 8352 is a high performance power quality analyzer, which makes all measurements and analysis available simultaneously and in their entirety. If the equipment settings (see section 9) have been selected and all measurement connections have been connected, measurement can be started by pressing the button  [*Start Meas*]. The Option RMS hp appears after pressing the button  and is available after pressing the button  [*RMS hp*]. The following display appears on the screen:

30sec RMS	1	2	3	4	
U RMS					
U [V]	977,06	977,57	961,51	0,00	
Umax [V]	978,46	978,22	962,17	0,00	
I RMS					
I [A]	744,36	772,56	796,75	0,00	
Umax [V]	977,07	971,58	975,26	0,00	
Imax [A]	893,13	926,40	947,13	0,00	
Time	16/07/2004 09:54:39	16/07/2004 09:54:45	16/07/2004 09:55:02	02/01/1904 02:00:00	
I RMS					
I [A]	744,00	772,78	786,79	0,00	
Umax [V]	894,38	928,45	948,61	0,00	
Umax [V]	975,06	972,06	976,08	0,00	
Time	16/07/2004 09:54:06	16/07/2004 09:52:48	16/07/2004 09:53:05	02/01/1904 02:00:00	
I RMS					
I [A]	743,71	771,69	786,07	0,00	
Umax [V]	977,39	977,42	960,49	0,00	
Time	16/07/2004 09:52:12	16/07/2004 09:54:23	16/07/2004 09:51:50	02/01/1904 02:00:00	

Figure 10.51: Option RMS hp

[illegible]

1



†


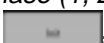

1


1

T

A

3

Functions/ Options	Remarks
U in [V]	<i>R.m.s. values of the voltage (integrated over a half cycle) of all connected phases (1, 2, 3, N)</i>
Umax in [V]	<i>Maximum half cycle r.m.s. value of the voltage of the respective phase (1, 2, 3, N): since last pressing , or during the actual saving interval (with storing activated)</i>
Iumax in [A]	<i>Half cycle r.m.s. values of the current of the respective phase (1, 2, 3, N) at the time of the Umax occurrence (see Tumor)</i>
Tumor	<i>Date and time of the occurrence of Umax</i>
Umin in [V]	<i>Minimum half cycle r.m.s. values of the voltage of the respective phase (1, 2, 3, N) since last pressing , or during the actual saving interval (with storing activated)</i>
Iumin in [A]	<i>Half cycle r.m.s. values of the current of the respective phase (1, 2, 3, N) at the time of the Umin occurrence (see Tumin)</i>
Tumin	<i>Date and time of the occurrence of Umin</i>
I in [A]	<i>R.m.s. values of the current (integrated over a half cycle) of all connected phases (1, 2, 3, N)</i>
Imax in [A]	<i>Maximum half cycle r.m.s. values of the current of the respective phase (1, 2, 3, N) since last pressing , or during the actual saving interval (with storing activated)</i>
Uimax in [V]	<i>Half cycle r.m.s. values of the voltage of the respective phase (1, 2, 3, N) at the time of the Imax occurrence (see Timax)</i>
Timax	<i>Date and time of the occurrence of Imax</i>

I_{min} in [A]	<i>Minimum half cycle r.m.s. values of the current of the respective phase (1, 2, 3, N) since last pressing , or during the actual saving interval (with storing activated)</i>
U_{imin} in [V]	<i>Half cycle r.m.s. values of the voltage of the respective phase (1, 2, 3, N) at the time of the I_{min} occurrence (see T_{imin})</i>
T_{imin}	<i>Date and time of the occurrence of I_{min}</i>

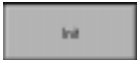



Note: The meaning of the indicated values of some parameters depends upon the selected circuit diagram (see section 9.2, page 51).



10.12.3 Right button panel: menu buttons and their functions

Note: All buttons are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

10.12.3.1 Overview

	... Page 188
	... Page 188
 (gray)  (green)	... Page 188

10.12.4 Half cycle measurement indicators

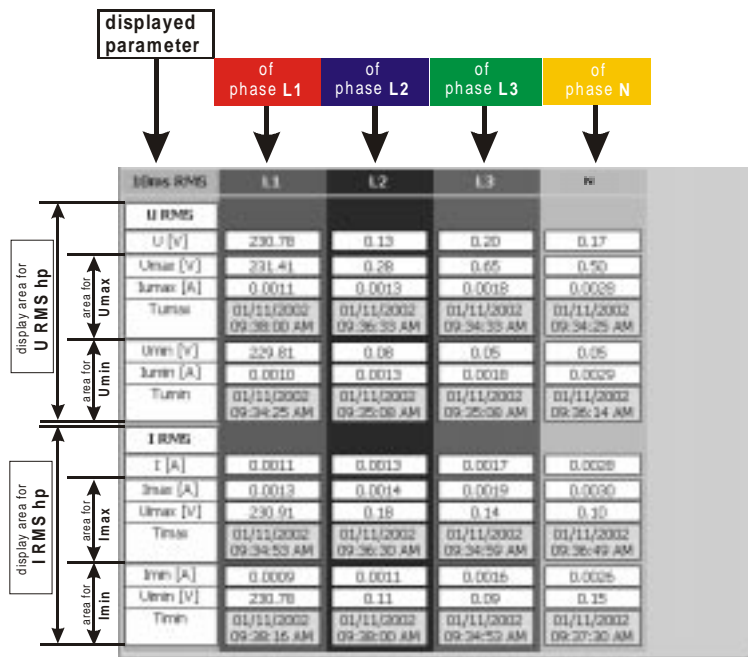
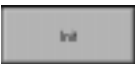


Figure 10.52: Overview of the tabular display



By pressing the button **[Init]** all values in the Umax, Umin, Imax, and Imin display areas of the individual phases are reset to 0 (see Figure 10.52: Overview of the tabular display)



By pressing the button **[Print]** the „Print Panel“ appears. Within this panel it is possible to print the current display and/or save it as a BMP-file. More about this button, see page 105.





This button cannot be activated. It serves only as information about whether data recording is taking place or not. Data recording is taking place, if this button is green. Data recording is activated, but there has not been any recording yet, when the button is yellow. To change to the module for data recording is possible at any time by pressing the button **[Store]** in the Module-Options-Panel.

11 C.A 8352-Post (Data analysis)

Post

The program „C.A 8352-Post“ is a comprehensive tool for the representation and post measurement analysis of saved measurements. It also offers the possibility of a standardized protocol for the analysis of the measurements and/or exporting the results into other programs.

11.1 Starting C.A 8352-Post

The post-measurement data analysis program can be started directly at the instrument with the button  in the module **[System]** (see section 9.2 ) of the measurement program „C.A 8352Meas“ or from an external PC via the file „C.A 8352Post.exe“ in the folder „C.A 8352Post“ (see installation instructions).

Running the program scans the standard file of saved measurement data (...\\C.A 8352\\Data2) for saved series of measurements and lists these in the start-screen (see section 11.2) for selection.

Note: The procedure for the selection of the measurement data is managed in a status window („DATA Server“) and possible errors are indicated.



This function serves **only as information**.

11.2 Start screen

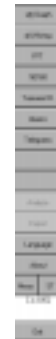


Figure 11.1: Start screen C.A 8352-Post

Note: All buttons are in the activated position as soon as they are pressed and/or are displayed in the pressed position when activated.

Right button panel:

On the right side of the screen one finds the **action-panel** (see page 191 for a summary of the buttons and their functions) for switching to different data analysis functions and other menu buttons available within the program „C.A 8352-Post“.



11.2.1 Right button panel: menu buttons and their functions

11.2.1.1 Overview - General options

Language	... Page 198
About	... Page 198
Meas	... Page 198
ST	... Page 198
Exit	... Page 198

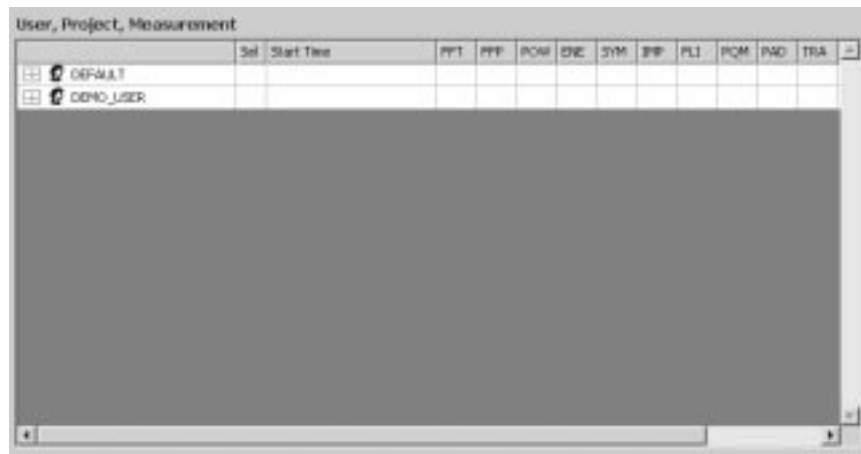
11.2.1.2 Overview – Data analysis-options

x(t) Graph	... Page 199
x(t) Histog	... Page 210
FFT	... Page 220
50160	... Page 231
Transient R.	... Page 250
Telegrams	... Page 262
Analyze	... Page 196
Export	... Page 197

11.2.2 Selection of a particular measurement

Upper area of the display


After a restart, the upper area of the display shows a listing of all existing "*Users*", under whose names series of measurements were saved in the standard file:





User, Project, Measurement											
Sel	Start Time	PFT	PFF	PCW	CSE	SYM	JFP	PLI	PCM	PSD	TRA
+											
+											

Figure 11.2: Start screen C.A 8352-Post, upper display area (1)

Note: The designation "DEFAULT" is present in this display for series of measurements, where no user name was entered.

By pressing the - field next to the displayed *user* names, the *project* names saved under the respective *user* name are listed.

According to the same principle (pressing the - field next to the displayed *project* names) the *measurements* saved under the respective *project* name are listed (**Note:** Names for the measurements can be entered during the recording of the measurement; see section 9.3).

Note: By pressing the - field, the respective procedure is cancelled.

User, Project, Measurement		Sel	Start Time	FFT	RF	POW	ENE	SYM	IMP	FLI	PCM	PAI	TRA
DEFAULT													
DEMO_USER													
DEMO_PROJECTS													
name of the record		<input type="checkbox"/>	08:47:58 02/12/2002	X	X	X	X	X	X	X	X	X	X
name of the record		<input type="checkbox"/>	08:48:02 02/12/2002	X	X	X	X	X	X	X	X	X	X
name of the record		<input type="checkbox"/>	08:48:08 02/12/2002	X	X	X	X	X	X	X	X	X	X
name of the record		<input type="checkbox"/>	08:48:49 02/12/2002	X	X	X	X	X	X	X	X	X	X
name of the record		<input type="checkbox"/>	08:57:46 02/12/2002	X	X	X	X	X	X	X	X	X	X
name of the record		<input type="checkbox"/>	09:01:52 02/12/2002	X	X	X	X	X	X	X	X	X	X
name of the record		<input type="checkbox"/>	09:02:42 02/12/2002	X	X	X	X	X	X	X	X	X	X
name of the record		<input type="checkbox"/>	09:06:02 02/12/2002	X	X	X	X	X	X	X	X	X	X
00023		<input type="checkbox"/>	09:06:33 02/12/2002	X	X	X	X	X	X	X	X	X	X
00024		<input type="checkbox"/>	09:07:18 02/12/2002	X	X	X	X	X	X	X	X	X	X
00025		<input type="checkbox"/>	09:09:23 02/12/2002	X	X	X	X	X	X	X	X	X	X
name of the record		<input checked="" type="checkbox"/>	09:09:34 02/12/2002	X	X	X	X	X	X	X	X	X	X
name of the record		<input type="checkbox"/>	09:20:29 02/12/2002	X	X	X	X	X	X	X	X	X	X

Figure 11.3: Start screen C.A 8352-Post, upper display area (2)

Symbols:





In the case of this measurement (one row corresponds to a set of measurement data) the data of the measurement option described at the top of the column **are saved**.



In the case of this measurement (one row corresponds to a set of measurement data) the data of the measurement option described at the top of the column **are not saved**.

The selection of a particular data record (which is to be analyzed further) is done by pressing the field next to the date of the appropriate measurement (☒ 09:09:34 02/12/2002) and is cancelled again with the same procedure (☐ 09:09:34 02/12/2002).

Note:

After selection of a *measurement* the button  (for starting the desired type of data analysis) and the button  (for exporting a data record) is activated.

Note:

Selection of 2 measurements: A maximum of only 2 measurements, whose saved data correspond to the field "group" (those are all measurement options except for "transient", "telegram", "alarm"; see section 9.3) can be selected at the same time and therefore be compared with each other with regard to their time dependence.

After its selection, the lower display area shows information about the selected measurement:

Figure 11.4: Start screen C.A 8352-Post, lower display area (1)

Printing a measurement's setup report

[illegible]

Figure 11.5:
Details & Manage - window

Deleting (parts of) the selected measurement

Click on the  - button to enter the submenu, where you can delete the whole measurement or only parts of the measurement:

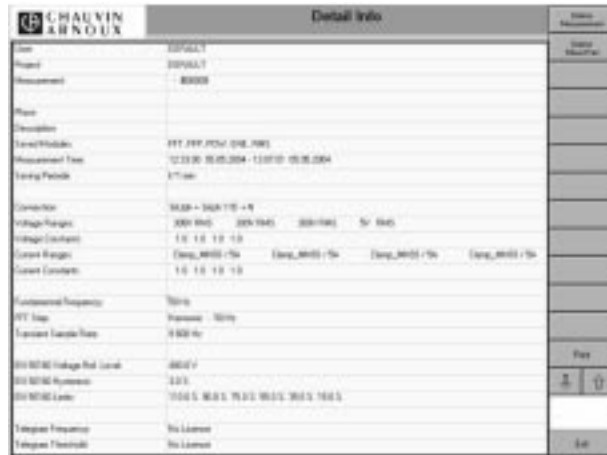
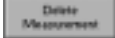
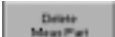


Figure 11.6: Details & Manage - window

If you click on the  - button the whole selected measurement will be deleted and you return to the start-screen.


If you click on the  - button a sub-window appears, where you can select, which part of the measurement should get deleted:



Just select the time-interval, which you want to delete by shifting the bars or by entering time/date manually.

11.2.3 Starting an analysis of a measurement

After selection of the desired measurement (or two measurements), only the analysis-options, that are possible for the type of the selected measurement, become active on the right button panel.

Note: The button  is activated **after selection of a measurement** (for starting the desired type of data analysis).

Depending upon the desired type of analysis, one of the appropriate buttons must be pressed.


The analysis procedure is started by pressing the button  and always begins with a pre-selection window for the time interval of the measurement, which is to be analyzed:




Figure 11.7: Time preselect window

The preset values correspond to the current start and end times of the selected measurement. They can be changed by entering them directly in the fields or by moving the two bars.

Note: In most cases, it is recommended that the entire measurement period will be displayed first and a "Zoom" function (within Data Analysis Options) allows individual measurement sections to be viewed in more detailed way.

11.2.4 Exporting measurement data

After selection of a given measurement, parts of the saved measurement data of this measurement can be exported in a .txt file (saving in tabular form in a text file). The new file ("... .txt") is saved in the file "...Data2_EXPORT "and may be opened and/or worked on from here.

Note: The button  is activated **after selection of a measurement** (for exporting a data record).



After pressing the button , a window opens for the selection of the type of measurement data, which are to be exported:




Figure 11.8: Export –selection window

11.2.5 Changing the language of the user interface

After pressing the button , a window opens in which the language selection of the programs surface can be changed:




11.2.6 Software information


After pressing the button , a window opens in which information about the software is provided.




11.2.7 Return to the measurement software³⁸

Pressing the button  terminates "C.A 8352-Post" and calls up the program "C.A 8352-Meas" which serves for the measurement and recording of the power network parameters (see sections 9 and 10).

11.2.8 System settings³⁸

Pressing the button  starts the program "SystemTool" with which system settings, such as printer installation, system time setting, software updates, etc. can be carried out (see section 9.4).

11.2.9 Terminating the program ("C.A 8352-Post")

This possibility exists only with direct installation and use of the program on a PC. In this case the program "C.A 8352Post" is terminated with the button .

³⁸ This possibility exists only if the program "C.A 8352Post" were started from the measurement program ("C.A 8352Meas") directly at the measurement instrument.

11.3 Analysis options

11.3.1 Analysis with option $x(t)$ graph

$x(t)$ Graph

After the procedures described in sections 11.2.2 and 11.2.3, the button $x(t)$ Graph appears pressed and after a delay in which the data is read in for measurement, the data are displayed as shown below:

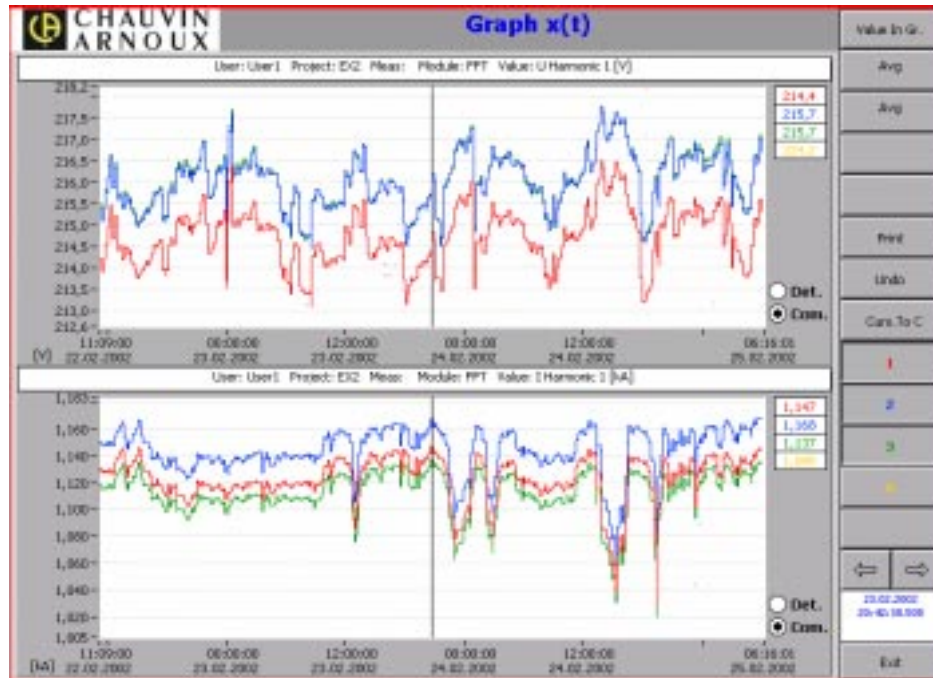


Figure 11.9: Start screen within the analysis option [$x(t)$ -Graph]

11.3.1.1 Main display area

11.3.1.1.1 Display in "Compare" mode ("Com")

This mode is activated when the "Com" field is activated in both graphs (see Figure 11.10: [x(t)-Graph] – display in „Compare“- mode

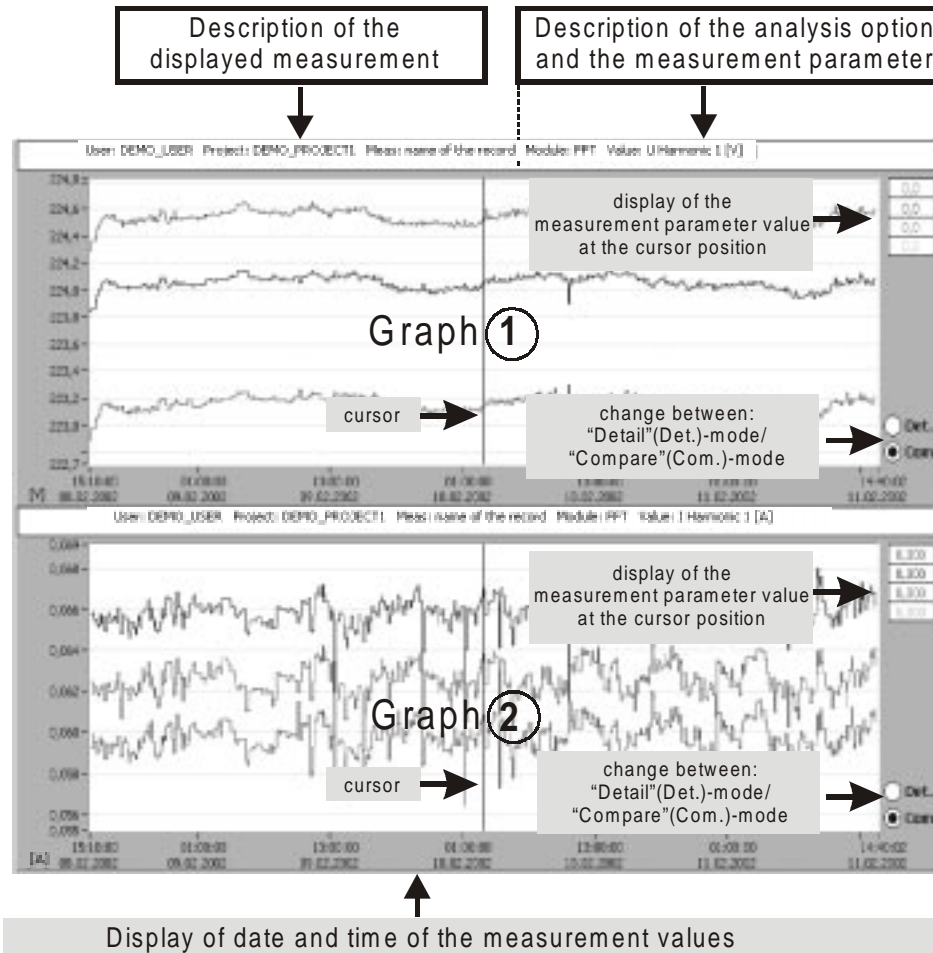


Figure 11.10: [x(t)-Graph] – display in „Compare“- mode

In this mode, in graphs 1 and 2 **the time dependence of two different parameters on one measurement** or **the time dependence of one parameter on 2 separate measurements** (selection of two measurements, see section 11.2.2) can be displayed and compared.

Moving the cursor: see page 208

Zoom function:

Through the „**Zoom**“ mechanism (touchscreen: touch the screen at a desired position on the screen with the pen, move it to the desired final position and take the pen off the screen again; mouse: click on a position with the left mouse button and drag the cursor to the desired position and release the mouse button again) individual areas **in the area of a graph** can be zoomed out. This zoom function affects the other graph at the same time.

(To reset the zoom function, see page 208)

Changing the scaling of the y axis:

By clicking (mouse) and/or tapping (touchscreen) the y axis of one of the two graphs, a "Pop up" window opens in which the scaling of the y axis can be changed:



In this window it is possible for the user to manually enter the scaling (manual setting and input of the desired min/max values), to fit the level of the displayed values automatically by autoscaling (*Autoscale* setting) or to freeze the current scaling (scaling *Lock*).

In addition, the set scaling option can be specified as to whether it applies to the upper graph (setting "Graph 1"), the lower graph (setting "Graph 2") or to both graphs (setting "Graph 1 & 2").

11.3.1.1.2 Display in Detail mode ("Det")

This mode is activated while the "Det." field is activated in one of the two graphs (see Figure 11.11: [x(t)-Graph] – display in „Detail“- mode

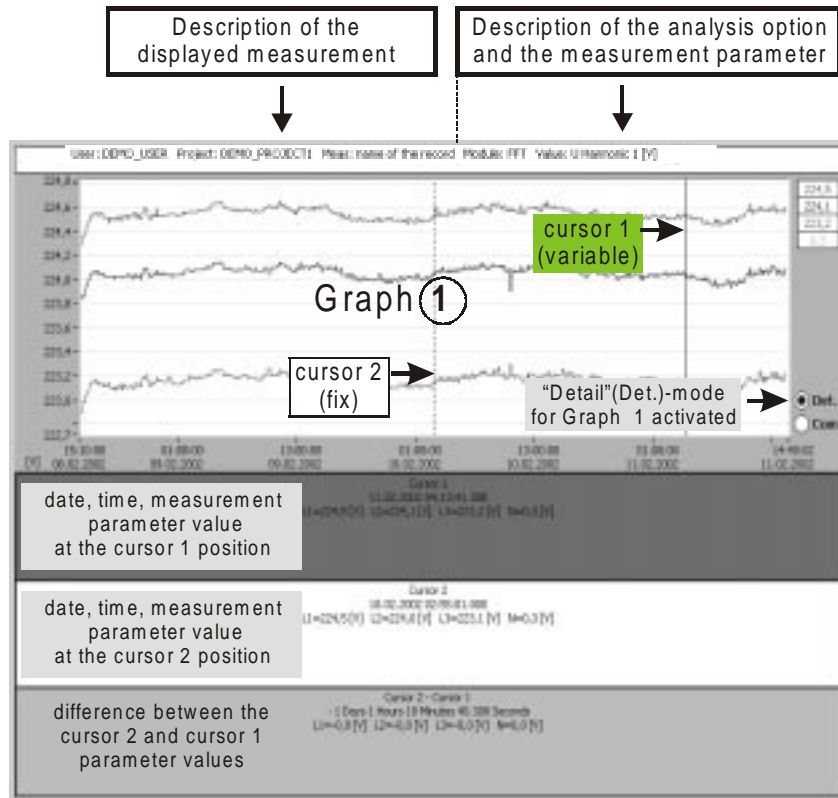


Figure 11.11: [x(t)-Graph] – display in „Detail“- mode

In this mode, the **time dependence of a measurement parameter** in one of the two graphs can be analyzed in more detail with the aid of a 2nd cursor.

Moving the (variable) cursor: see page 208

In this mode, individual sections can also be zoomed and the scaling of the y-axis can be changed (see section 11.3.1.1.1).





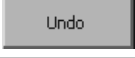
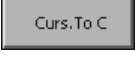
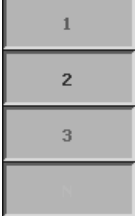


Right button panel:

On the right hand side of the screen one finds the **action-panel** (overview of the buttons and their functions: page 203) for switching to different data analysis functions and other menu buttons available within the analysis option [*x(t)-Graph*].



11.3.1.2 Right button panel: menu buttons and their functions

11.3.1.2.1 Overview

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	... Page 206
	... Page 206
	... Page 206
	... Page 208
	... Page 208
	... Page 208
	... Page 208
	... Page 209

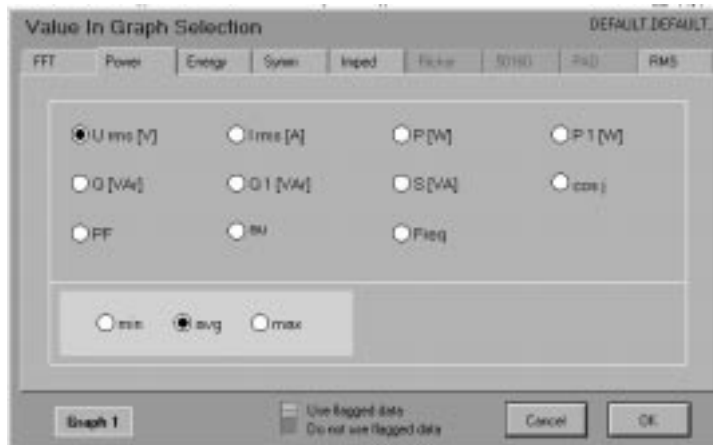
³⁹ Drop-down menu by pressing the button

11.3.1.2.2 Detail

Value In Gr.

By pressing this button, different measurement parameters can be selected whose time dependence is represented in the graphs 1 and 2.

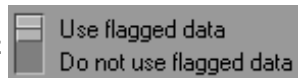
The following selection window opens:



In the lower area of this window (**Graph 1**), the graph is designated for which the measurement parameter is directly selected (graph 1 or 2, see Figure 11.10: [x(t)-Graph] – display in „Compare“- mode

By clicking on this one moves to the selection for the next graph, i.e. from graph 1 to graph 2 or vice versa.

“Flagging”⁴⁰ concept



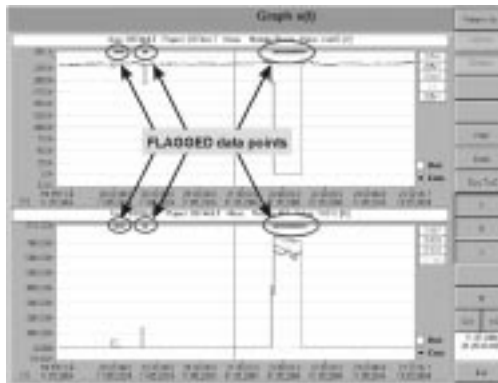
During a dip, swell or interruption the calculated values for power frequency, voltage magnitude, flicker, supply voltage unbalance, voltage harmonics, voltage interharmonics, mains signaling are marked as “flagged”. If during a given time interval any value is flagged, the aggregated value over a storing period (stored value) including that value shall also be flagged.

The user can decide afterwards, if he uses these values for

⁴⁰ see [2]: IEC 61000-4-30 “Flagging concept”

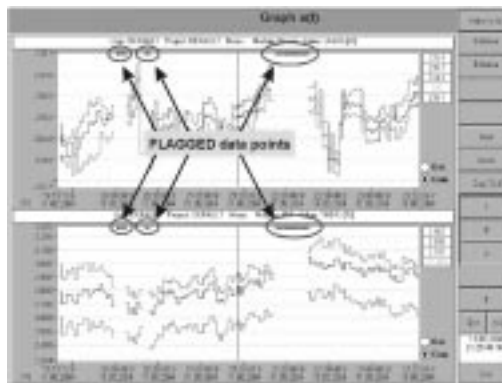
further evaluation or not.
For example:

A time diagram of a measurement with flagged data, where you decided to show all data ("Use flagged data"), will show all data, but with black marks above the flagged data points.



**Figure 11.12: time diagram
with „Use flagged data“ selected**

Now have a look on the same time diagram with "Do not use flagged data" selected. In this case the time diagram does not show the value of the flagged datapoints themselves, but also the black marks on their position.



**Figure 11.13: time diagram
with „Do not use flagged data“ selected**

Note:

If 2 different measurements are selected for simultaneous analysis, the program assigns one measurement to graph 1 and the other measurement to graph 2.

Avg

and

Avg

By pressing this button, a selection can be made, whether the average value (**AVG**), minimum value (**MIN**), maximum value (**MAX**) or minimum and maximum value together in one diagram (**EXTREMA**) of the selected measurement parameter is to be represented as its time dependence. This selection shows effects to the displayed graph, in the case that not all data points of the selected time period can be displayed on the screen (caused by the limited screen resolution), because of too many data points.

Example: There are 3000 data points (measurement points), which should be displayed in one graph. The screen can display only (because of his resolution) 1000 points. A selection of Avg (average value) effects that the present diagram is converted to a displayable size (in our case 1000 data points). In this case the mean value over 3 sequenced data points is built and shown as one data point on the screen. By selection *Min* (minimum value) the lowest, in case of selection *Max* (maximum value) the highest of the 3 data points will be displayed.

The upper one of the two buttons shows effects to the display of graph 1, the lower one to the display of graph 2.

Print

With this button, the standardized protocol for this analysis can be printed out on the system printer (for printing directions, see section 9.4) and/or saved in a ".bmp " or ".html" file. Information such as measurement site, description, etc. can be entered in a "pop-up" window (protocol title and selected measurement parameters of the two graphs have been entered from the preset values). Further, the thickness of the line can be changed (—) and a selection can be made, whether the print-out will be in color or black and white (■).



The type of print-out can be defined with this button.

Note:

The print-out is sent to the file „...\Data2\User\Project_Print_Outs“ as a „.bmp“ or „.html“ file.



Attention: If the selected type is a „.html“ file, all entries in the file „..._Print_Outs“ will be deleted.



By pressing this button, it is possible to do the printer settings and/or change the type of printer (Print Setup).



Auto Update Labels

If this field is activated, the title of the print-out is adapted to suit the current analysis option.

By deactivating this button, the user's own title can be entered which then also appears in the print-out of all other analysis options.

In this analysis option, the print-out has the following appearance:



Figure 11.14:
Protocol of the analysis option [x(t)-Graph]

Undo

By pressing this button, the display in both graphs is reset to display the entire measurement span.

Curs.To C

This button resets the cursor to the center of the displayed series of measurements in both graphs

1

2

3

With these buttons, it is possible to switch on/off individual inputs to the graphs (e.g. phase values). Only activated inputs to the graph are represented.

Input 1 = red
Input 2 = blue

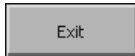
Input 3 = green
Input N = yellow



10.02.2002
02:55:01.000

With these arrow keys, the cursor is moved simultaneously in both graphs.

In the display area below, the current cursor position is shown as a date and time.



This button terminates the analysis option **[$x(t)$ -Graph]** and returns the user to the start-screen of the program "C.A 8352-Post" (see section 11.2).



11.3.2 Analysis with option $x(t)$ histogram

$x(t)$ Histog

After the procedures described in sections 11.2.2 and 11.2.3, followed by pressing the button $x(t)$ Histogram and a certain amount of time, in which the desired measurement data are read in, a display with following structure appears:

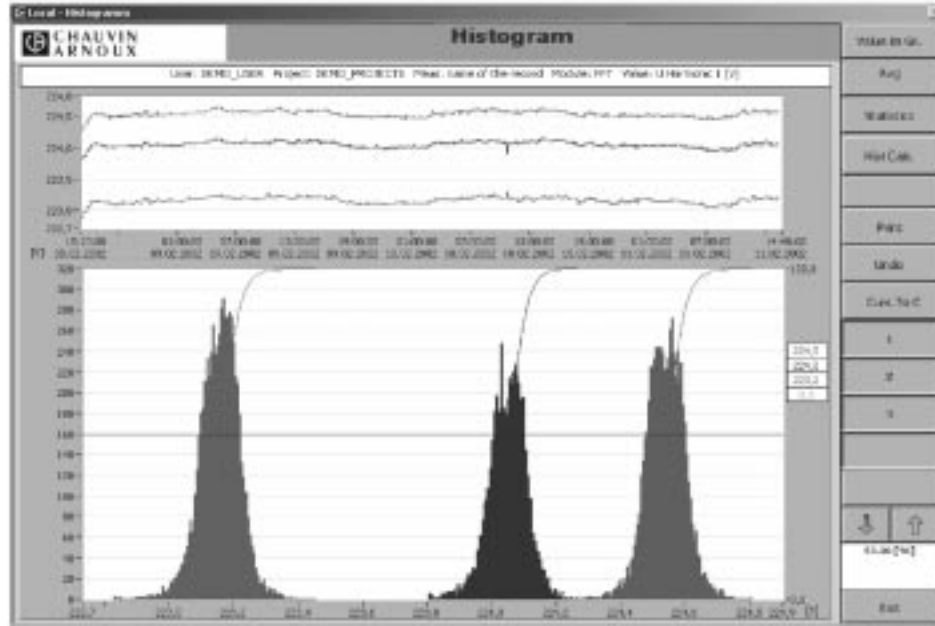
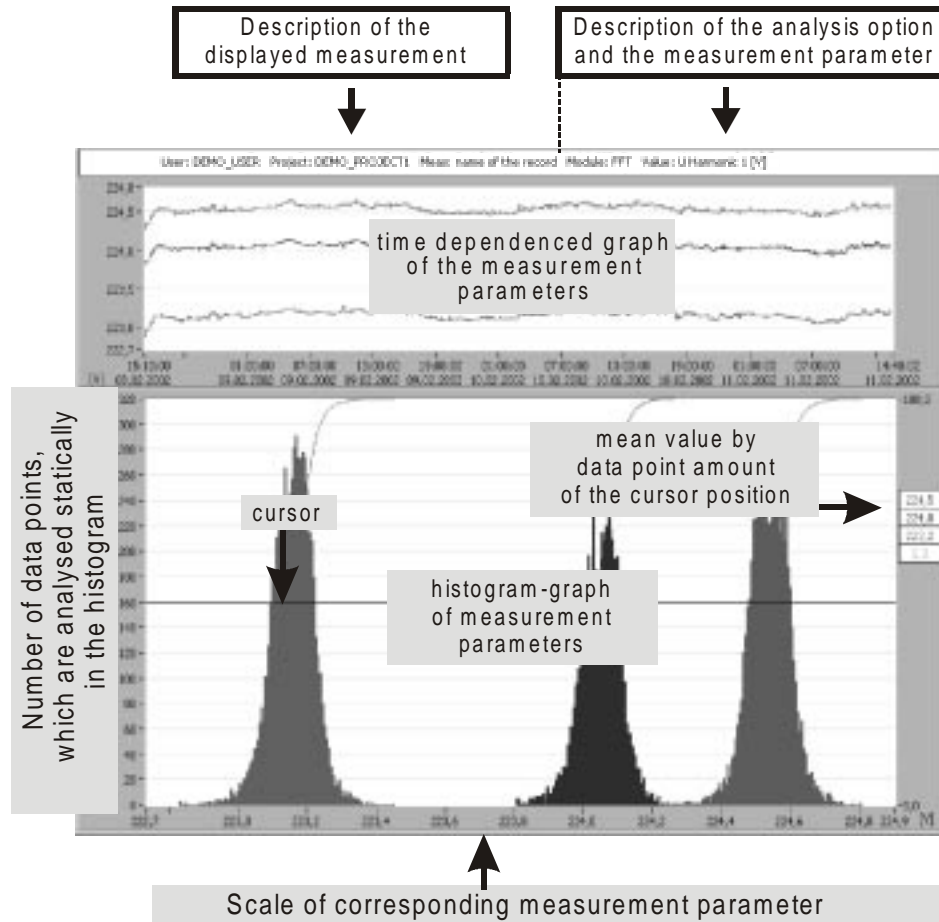


Figure 11.15: Start screen within analysis option [$x(t)$ -Histog]

11.3.2.1 Main display area



**Figure 11.16: Start screen within the analysis option
[x(t)-Histog]; overview**

The time dependence of a measurement parameter is displayed in the upper graph, the histogram evaluation and the cumulative distribution of the data points of the selected time period is shown in the lower diagram.

Moving the cursor in the histogram representation:

see page 218.

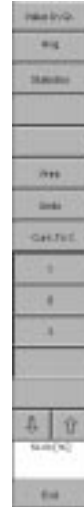
Zoom function:

Through the **"Zoom"** mechanism (touchscreen: tap the screen with the pen, drag it to the desired position and take the pen off the screen again; mouse: click on a position with the left mouse button and drag the cursor to the desired position and release the mouse button again) individual areas **in the area of a graph** can be zoomed out. This zoom function affects the other graph at the same time; only the "zoomed" data area of the histogram analysis is presented.

(To reset the zoom function, see page 218)




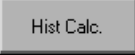


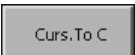
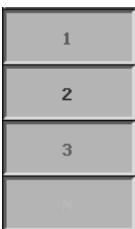
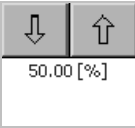

Right button panel:

On the right hand side of the screen one finds the **action-panel** (overview of the buttons and their functions: Page 213) for switching to different data analysis functions and other menu buttons available within the analysis option **[$x(t)$ -Histogram]**.



11.3.2.2 Right button panel: menu buttons and their functions

11.3.2.2.1 Overview

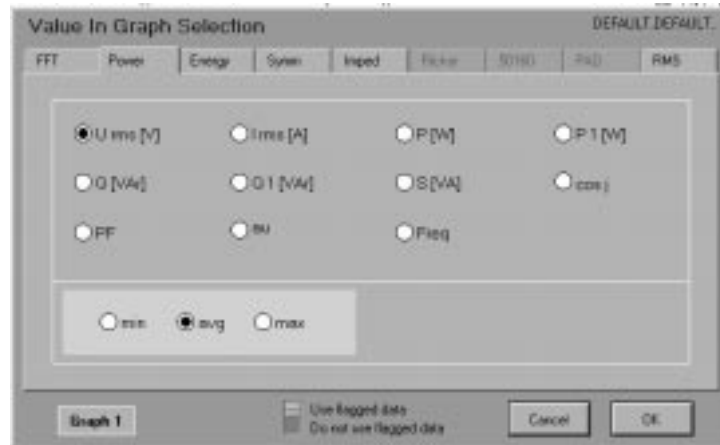
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	... Page 218
	... Page 218
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⁴¹ Drop-down menu by pressing the button

11.3.2.2.2 Detail

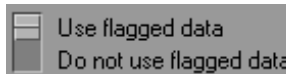
Value In Gr.

By pressing this button, different measurement parameters can be selected whose time dependence and histogram will be re-presented. The following selection window opens:



In the lower area of this window (**Graph 1**), the graph is designated for which the measurement parameter is directly selected. By clicking on this one moves to the selection for the next graph, i.e. from graph 1 to graph 2 or vice versa.

“Flagging”⁴² concept



: see page

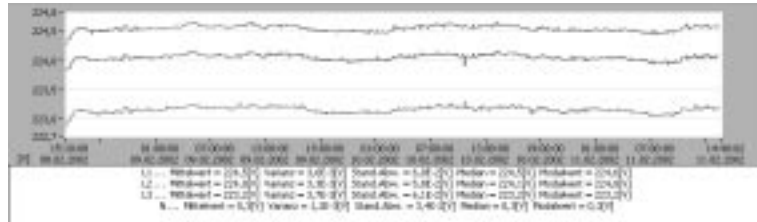
204.

Avg

By pressing this button, a selection can be made, whether the average value (**AVG**), minimum value (**MIN**), maximum value (**MAX**) or minimum and maximum value together in one diagram (**EXTREMA**) of the selected measurement parameter is to be represented as its time dependence. (for more information see 11.3.1.2.2, page 206). This function does not have an effect on the histogram representation.

⁴² see [2]: IEC 61000-4-30 “Flagging concept”

By pressing this button, statistical values of the selected measurement parameter (standard deviation, average value, etc.) can be displayed. These are analyzed over all measurement points of the time dependence diagram's displayed time range. The display appears in a window below the time diagram:



Explanations of the statistic values:

- **arithmetic average value:** This is the sum of all measurement values divided by their number.
- **Variance:** This is formed by taking the difference of each individual measurement value from the (arithmetic) average value that has been determined, squaring these differences and then summing all resulting values. This sum is then divided by the number of measurement values, producing the "variance" (or "mean square difference").
- **Standard deviation:** Is the square root of the variance.
- **Median:** The value which divides a frequency distribution into 2 parts in such a way, that equally as many measurement points lie below this point as above it.
- **Modal value:** The most frequently occurring value in a frequency distribution; corresponds therefore to the maximum in the histogram.
- **Points for calc:** number of data points, which are displayed in the histogram.
- **Total points:** number of data points of the selected time period (which are displayed in the time diagram).
- **Bin:** Size of one class of the histogram.

Hist Calc.

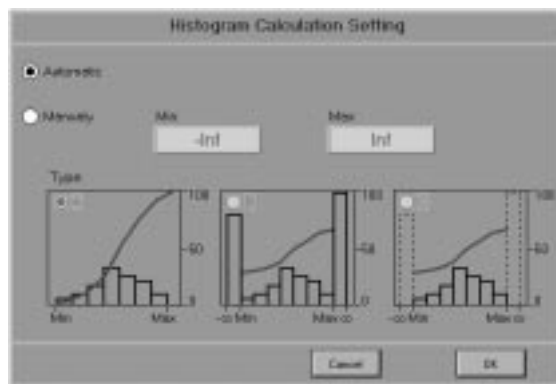
By pressing this button, you can change the type of histogram evaluation.

By default the PNA software **divides the difference between the minimum and the maximum value of the selected measurement parameter of the displayed time period into 100 classes** and classifies all the data points into these classes.

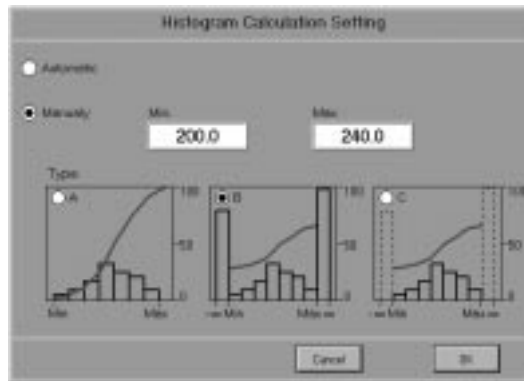
Especially when there are just a few data points with very different values to the rest of the data point-values, this leads to a histogram display with nearly no detailed information, because most of the data points are inside 1 class.

In such a case this choosing function helps to give nevertheless detailed histogram-information.

Following sub-window appears with the default setup **Automatic** (see description above):




Choose **Manually**:



Enter a minimum value (**Min**) and a maximum value (**Max**) manually to set the lower and upper limit for the classification into 100 classes.

Then choose the **Type** of evaluation:

- **Type A:** All data points outside the limits, set by Min and Max, are not evaluated in the histogram at all.
- **Type B:** All data points with values lower than the Min-limit are evaluated and displayed in the first class of the histogram. All data points with values higher than the Max-limit are evaluated and displayed in the last class of the histogram.
- **Type C:** All data points with values lower than the Min-limit are evaluated but not displayed in the histogram. All data points with values higher than the Max-limit are evaluated but not displayed in the histogram.

Selecting one of these Types has also got effects on the parameters *Points for calc.*, *Total points* and *Bin* of the Statistics-function, see , page 215.

If the **Hist.calc** function is activated, the button blinks red.

Print

For a precise description, see section 11.3.1.2.2, page 206. In this analysis option, the print-out appears as follows:

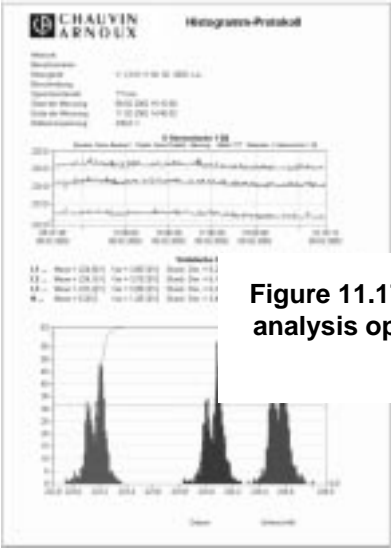


Figure 11.17: Protocol of the analysis option $[x(t)\text{-Histo}]$

Undo

By pressing this button, the display in both graphs is reset to the display and analysis of the entire measurement.

Curs.To C

This button causes a resetting of the cursor to 50% of the analyzed measurement data points in the histogram (the displayed values correspond to the "Median" value).

1

2

3

With these buttons, it is possible to switch on or off individual inputs (e.g. phase values) into the graph. Only activated inputs into the graph are represented.

Input 1 = red
Input 2 = blue
Input 3 = green
Input N = yellow

↓

↑

50.00 [%]

The cursor in the histogram display can be moved with these arrow keys.
The current cursor position in [%] of the analyzed measurement data points is indicated in the display area underneath.



With this button, the analysis option ***[$x(t)$ -Histogram]*** terminates and the user is returned to the start-screen of the program "C.A 8352-Post" (see section 11.2).



11.3.3 Analysis with option FFT

FFT

After the procedures described in sections 11.2.2 and 11.2.3, followed by pressing the button

FFT

 and a certain amount of time, in which the desired measurement data are read in, a display with following structure appears:

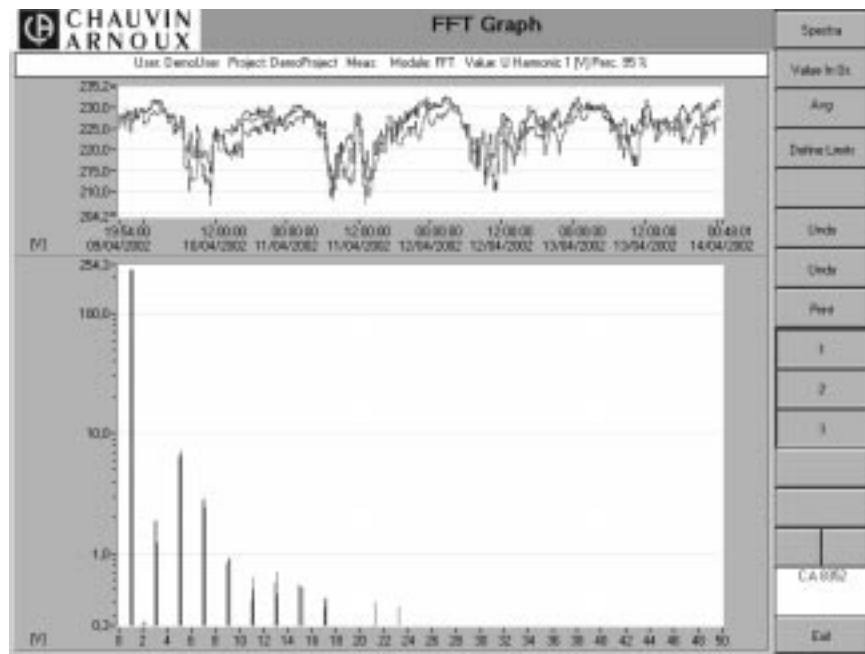


Figure 11.18: Start screen within the analysis option [FFT]

The display of the analysis option [FFT] always begins with a display of the spectral and the time dependent display of a measurement parameter.

11.3.3.1 Main display area

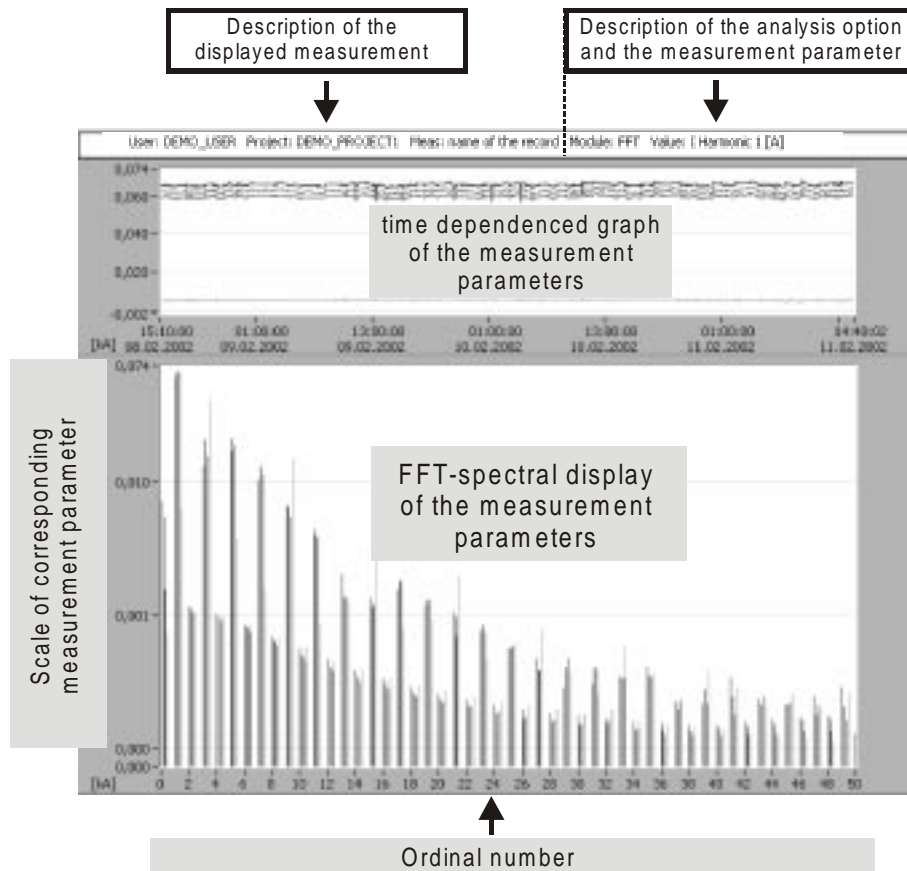


Figure 11.19: Start screen within the analysis option [FFT]; overview

Zoom function:

Through the "**Zoom**" mechanism (touchscreen: touch the screen at a desired position on the screen with the pen, move it to the desired final position and take the pen off the screen again; mouse: click on a position with the left mouse button and drag the cursor to the desired position and release the mouse button again) individual areas **in the area of a graph** can be zoomed out. This zoom function

affects the other graph at the same time, since only the zoomed data area will be applied for the FFT-analysis.

Through the "**Zoom**" mechanism **in the spectral display**, individual ordinal numbers of ranges can be zoomed.

(To reset the zoom function, see page 228)

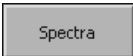

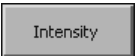
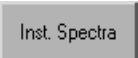
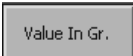


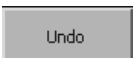

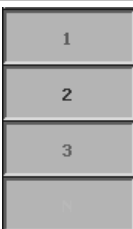


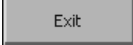
Right button panel:

On the right hand side of the screen one finds the **action-panel** (overview of the buttons and their functions: Page 223) for switching to different data analysis functions and other menu buttons available within the analysis option **[FFT]**.



11.3.3.2 Right button panel: menu buttons and their functions

11.3.3.2.1 Overview

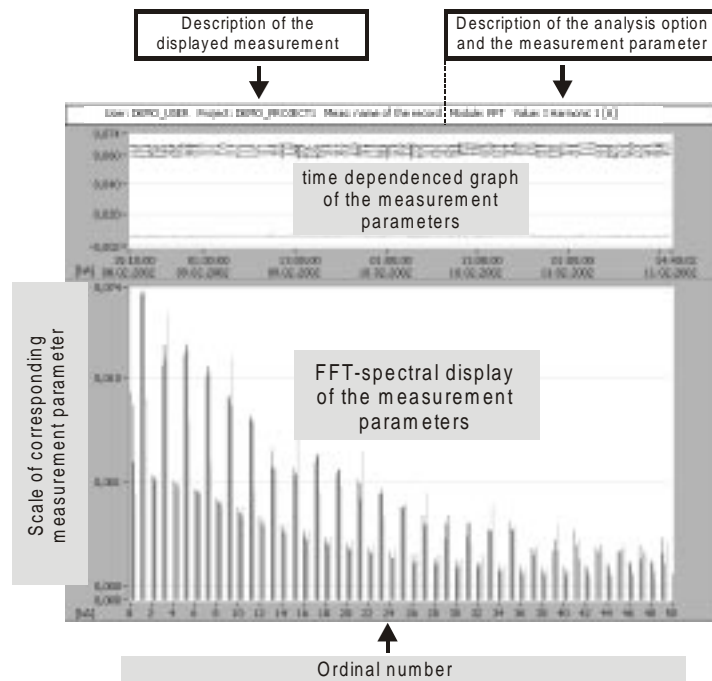
	⁴³	... Page 224
		... Page 224
		... Page 225
		... Page 226
		... Page 227
	⁴³	... Page 227
		... Page 227
		... Page 228
		... Page 228
		... Page 230
		... Page 230
		... Page 230
		... Page 230

⁴³ Drop-down menu by pressing the button

11.3.3.2.2 Detail

Spectra

By pressing this button, a spectral display of different measurement parameters and their time dependence can be displayed:



**Figure 11.20: Display analysis option
FFT-Spectra**

Table

By pressing this button, a tabular listing of the mean and maximum values, as well as thresholds of the individual frequency components (ordinal numbers) of different measurement parameters can be displayed:

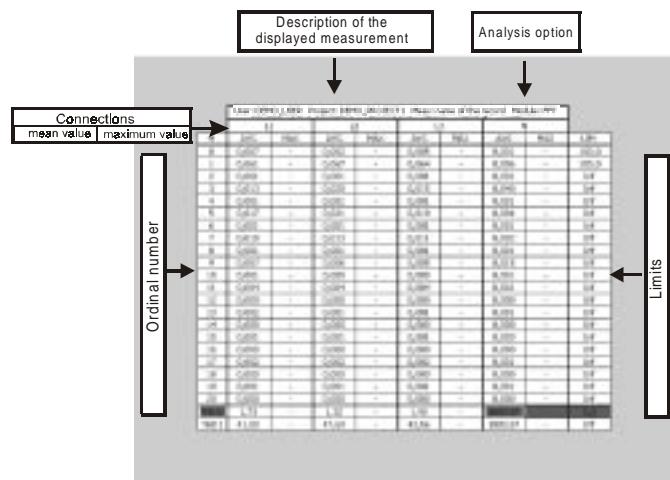
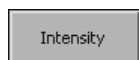


Figure 11.21: Display analysis option FFT-Table

A red coloring in the appropriate line simultaneously indicates a threshold exceeding.



By pressing this button, the density distribution of different measurement parameters and their time dependence can be displayed:

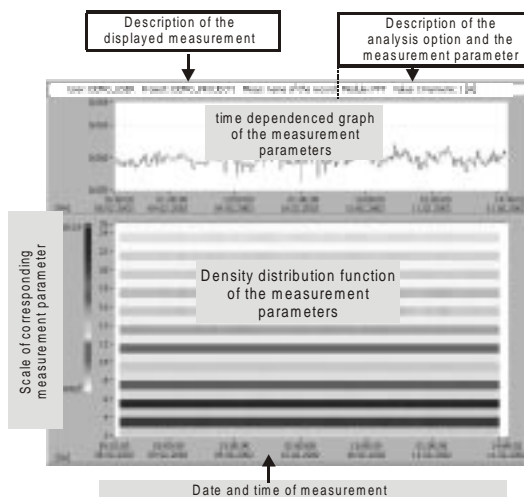
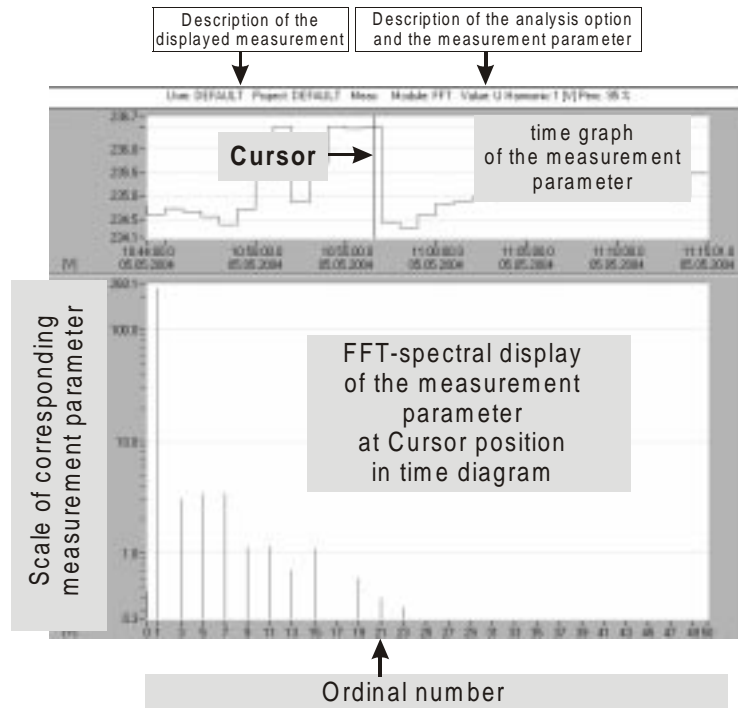




Figure 11.22: Display analysis option FFT- Intensity

By pressing this button, you get the possibility to see the FFT-Spectra for each storing point:

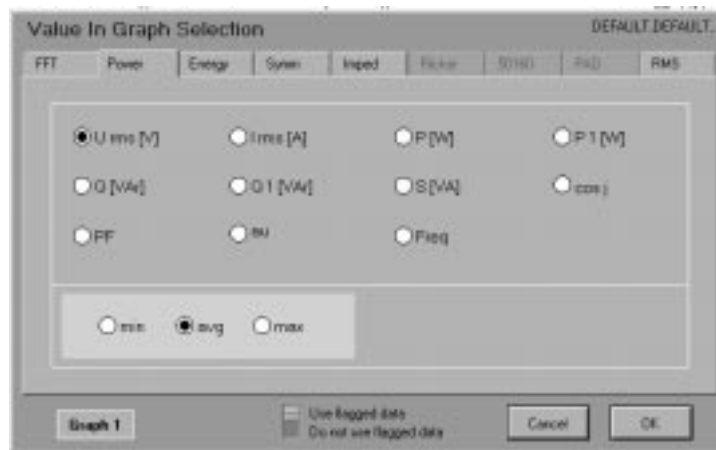


**Figure 11.23: Display analysis option
FFT- Inst. Spectra**


Just shift the Cursor position in the time diagram with the   -buttons to see the FFT-Spectra at this time.

Value In Gr.

By pressing this button, different measurement parameters can be selected for analysis. The following selection window opens:



In the lower area of this window (**Graph 1**), the graph is designated for which the measurement parameter is directly selected. By clicking on this one moves to the selection for the next graph, i.e. from graph 1 to graph 2 or vice versa.

“Flagging”⁴⁴ concept  Use flagged data
Do not use flagged data : see page 204

Avg

By pressing this button, a selection can be made, whether the *average* value (**AVG**), *minimum* (**MIN**) value or *maximum* (**MAX**) or minimum and maximum value together in one diagram (**EXTREMA**) of the selected measurement parameter is to be represented as its time dependence (for more information see section 11.3.1.2.2, page 206).

This function only affects the time dependence of the measurement parameter in the "Spectra" and "Intensity" display.

Define Limits

With this button, all threshold settings for the frequency components of current and voltage can be entered, changed, saved under a user-defined name, and reset again to standardized values from EN 61000-2-4. The following input window appears:

⁴⁴ see [2]: IEC 61000-4-30 “Flagging concept”

Level Limit Selection

Total Harmonic Distortion of voltage (THD)

	Class1 (%)	Class2 (%)	Class3 (%)
THD	0.00	0.00	1.00

Harmonics Voltage

Harmonic Order	Class1 (%)	Class2 (%)	Class3 (%)
1	1.00	2.00	3.00
2	0.00	0.00	0.00
3	1.00	1.00	1.00
4	0.00	0.00	0.00
5	0.50	0.50	1.00
6	0.00	0.00	0.00
7	0.00	0.00	0.00

Order Harmonics Voltage

Harmonic Order	Class1 (%)	Class2 (%)	Class3 (%)
4	2.00	2.00	3.00
5	2.00	2.00	3.00
6	0.00	0.00	0.00
7	0.00	0.00	0.00
8	1.00	1.00	1.00
9	1.00	1.00	1.00

Class 1 Class 2 Class 3

Order assignment

Class1

Class2

Class3

Class4

Class5

Class6

Class7

Class8

Class9

Class10

Class11

Class12

Class13

Class14

Class15

Class16

Class17

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Class300

Class301

Class302

Class303

Class304

Class305

Class306

Class307

Class308

Class309

Class310

Class311

Class312

Level Limit Selection

Total Harmonic Distortion of voltage (THD)

	Class1 (%)	Class2 (%)	Class3 (%)
THD	0.00	0.00	1.00

Harmonics Voltage

Harmonic Order	Class1 (%)	Class2 (%)	Class3 (%)
1	1.00	2.00	3.00
2	0.00	0.00	0.00
3	1.00	1.00	1.00
4	0.00	0.00	0.00
5	0.00	0.00	1.00
6	0.00	0.00	0.00
7	0.00	0.00	0.00

Order Harmonics Voltage

Harmonic Order	Class1 (%)	Class2 (%)	Class3 (%)
4	2.00	2.00	2.00
5	2.00	2.00	2.00
6	0.00	0.00	0.00
7	0.00	0.00	0.00
8	1.00	1.00	1.00
9	1.00	1.00	1.00

Class to Compare
☒ Class 1
☐ Class 2
☐ Class 3

Colour assignment
☒ Harmonics
☐ Load Multiplication of 3 Harmonics
☐ Load Multiplication of 3 Harmonics

OK Cancel Help

Cancel OK

Level Limit Selection

Total Harmonic Distortion of voltage (THD)

	Class1 (%)	Class2 (%)	Class3 (%)
THD	0.00	0.00	1.00

Harmonics Voltage

Harmonic Order	Class1 (%)	Class2 (%)	Class3 (%)
1	1.00	2.00	3.00
2	0.00	0.00	0.00
3	1.00	1.00	1.00
4	0.00	0.00	0.00
5	0.00	0.00	1.00
6	0.00	0.00	0.00
7	0.00	0.00	0.00

Order Harmonics Voltage

Harmonic Order	Class1 (%)	Class2 (%)	Class3 (%)
4	2.00	2.00	2.00
5	2.00	2.00	2.00
6	0.00	0.00	0.00
7	0.00	0.00	0.00
8	1.00	1.00	1.00
9	1.00	1.00	1.00

Class to Compare
☒ Class 1
☐ Class 2
☐ Class 3

Colour assignment
☒ Harmonics
☐ Load Multiplication of 3 Harmonics
☐ Load Multiplication of 3 Harmonics

OK Cancel Help

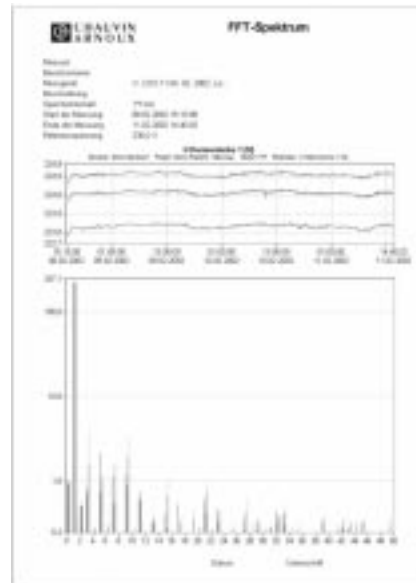
Cancel OK

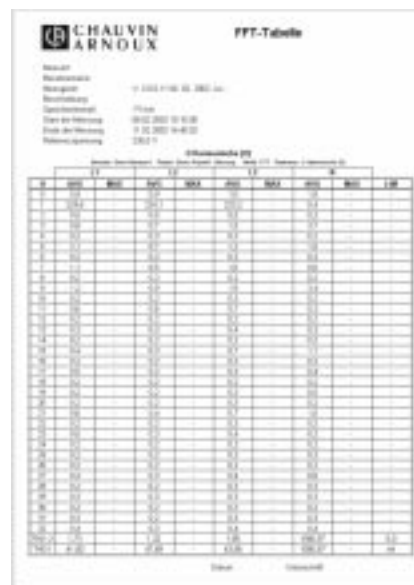
Undo

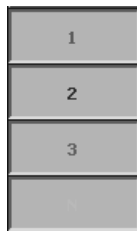
By pressing this button the display in the corresponding graphs is reset again to the display of the entire measurement.

Print

For a precise description, see section 11.3.1.2.2, page 206. In the FFT analysis option, the print-out appears as follows:







With these buttons, it is possible to switch on or off individual inputs (e.g. phase values) into the graph. Only activated inputs into the graph are represented.

Input 1 = red
Input 2 = blue

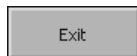
Input 3 = green
Input N = yellow



With these arrow keys, the tabular display can be paged through by further ordinal numbers, which are not currently displayed.



With these arrow keys, the cursor in the time graph of the Inst. Spectra function can be shifted with these arrow-buttons.



With this button, the analysis option **[FFT]** terminates and the user is returned to the start-screen of the program "C.A 8352-Post" (see section 11.2).

11.3.4 Analysis with option EN50160

50160

After the procedures described in sections 11.2.2 and 11.2.3, followed by pressing the button

50160

 and a certain amount of time, in which the desired measurement data are read in, a display with following structure appears:

EN50160 All					Total
	Min	Max	EN50160 (V)	EN50160 (V)	
Frequency	1 min (Hz) 49.98	1 min (Hz) 50.02	±0.02 100.00	49.98 100.00	
Voltage	Line 231.8 N 270.2 127.8	Line 406.8 N 405.8 406.1	Line 0.0% 100.00 N 0.0% 100.00 0.0% 100.00	Line 113.8% 180.00 N 180.00 05.8% 180.00	
Power		Power H 0.80 0.80 0.80	±1.0 100.00 100.00 100.00		
THD		THD max 2.63 2.81 1.10	±0.0% 100.00 100.00 100.00		
Unbalance		u max (V) 0.70	±0.0% 100.00		
Signal		U ug max 0.34 0.34 0.35	> 30% 100.00 100.00 100.00		
Harmonics					
Total					
Start Time 05.05.2004 12:33:00					Stop Time 05.05.2004 13:07:30
Flagged/All 1/33					Print
					Exit

Figure 11.27: Start screen within the analysis option [50160]

The display of the analysis option [50160] always begins with a summary of the parameters (**Total**), which are relevant to the evaluation of power quality parameters according to EN 50160 regarding possible threshold-exceedings.

11.3.4.1 Main display area

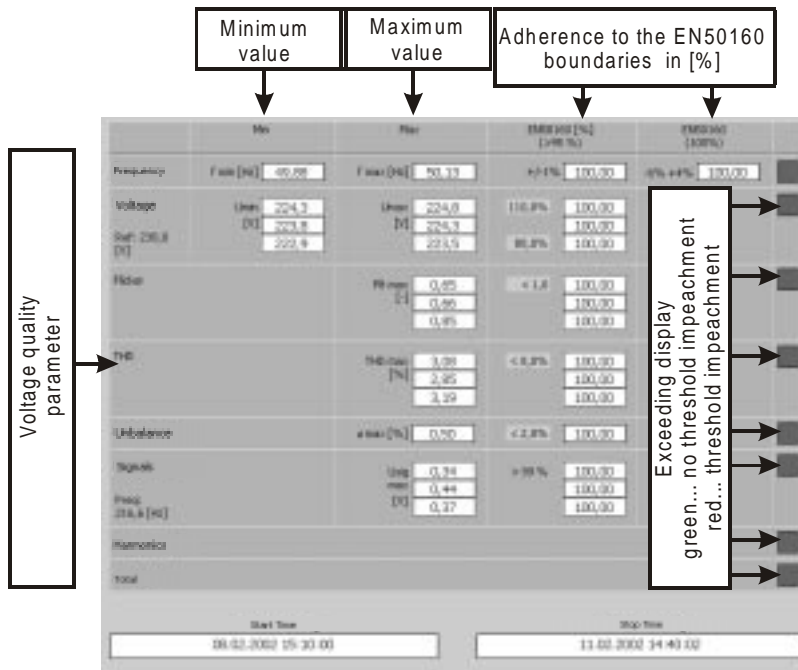


Figure 11.28: Start screen within the analysis option [50160]; overview

Right button panel:

On the right hand side of the screen one finds the **action-panel** (overview of the buttons and their functions: Page 233) for switching to different data analysis functions and other menu buttons available within the analysis option [50160].



11.3.4.2 Right button panel: menu buttons and their functions

11.3.4.2.1 Overview

Total	⁴⁵	... Page 235
Spectra		... Page 236
Event Table		... Page 237
Event List		... Page 237
CBEMA		... Page 238
RVC Eval		... Page 239
RVC List		... Page 241
RVC Table		... Page 241
RVC Days		... Page 243
Def. Limits		... Page 244
Exc. Flag		... Page 236
Inc. Flag		... Page 236
Filter		... Page 244
Print		... Page 247
Export		... Page 249

⁴⁵ Drop-down menu by pressing the button

1
2
3

... Page 249

↓
↑

... Page 249

Exit

... Page 249

11.3.4.2.2 Detail

Total Pressing this button produces a summary of the parameters with a display of occurred threshold-exceedings, which are relevant to the evaluation of power quality according to EN 50160.

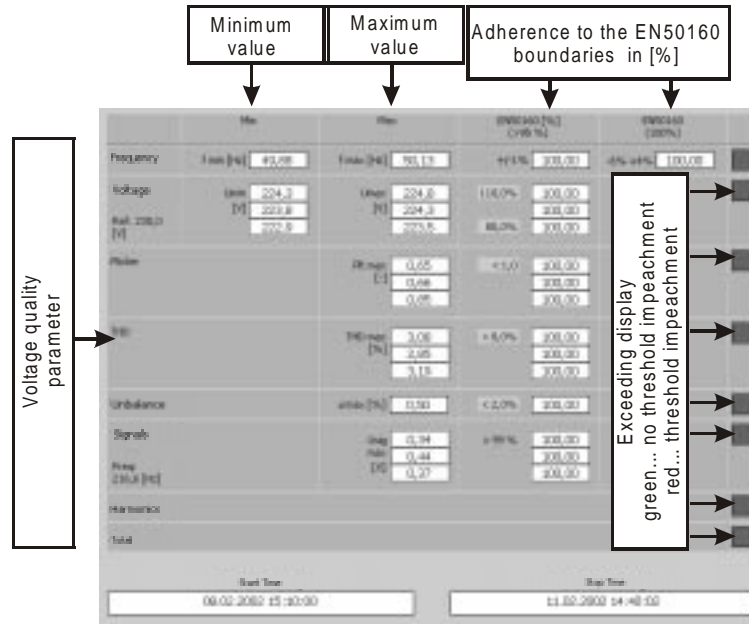


Figure 11.29: Display analysis option 50160- [Total]

Start and end of the measurement can be read in the lower display. Also the whole number of stored points together with the number of “flagged” points is shown.

“Flagging”⁴⁶ concept:

During a dip, swell or interruption the calculated values for power frequency, voltage magnitude, flicker, supply voltage unbalance, voltage harmonics, voltage interharmonics, mains signaling are marked as “flagged”. If during a given time interval any value is flagged, the aggregated value over a storing period

⁴⁶ see [2]: IEC 61000-4-30 “Flagging concept”

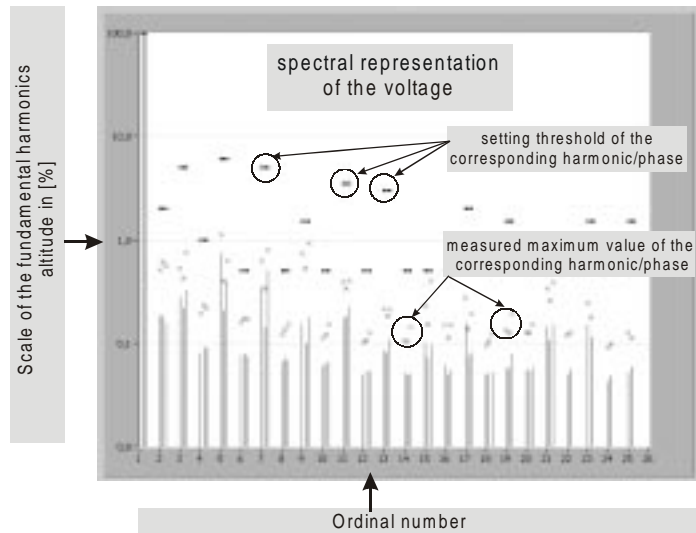
(stored value) including that value shall also be flagged.

The user can decide afterwards, if he uses these values for further evaluation not.

The evaluation according EN50160 can be done with “flagged”⁶¹ data () and without „flagged“ data ().

Spectra

In this analysis setting, a spectral representation of the voltage is produced with a simultaneous display of the maximum values and thresholds of the phases of all frequency components:



**Figure 11.30: Display analysis option
50160- [Spectra]**

This option shows all stored events, single-phase and 3-phase events, sorted in a table with different durations and residual voltages.

[illegible]

Figure 11.31: Display analysis option
50160- *[Event Table]*

The Start-threshold level for the calculation of the duration of the events is displayed at the bottom.

You can change the sorting fields for duration, but also the calculation start level for the calculation of the event's durations with the "Eve Calc."-option, see page 245.

This option shows a list of all events (threshold-exceedings), which have occurred, listed with sequential numbering, date, time, duration of the event and the phase in which the event occurred, as well as its residual voltage (Extrema).

No.	Date	Time	Phase	Extrema (V)	Duration (s)
1	08.12.2003	11:54:18	1	0.1	25.26
2	08.12.2003	11:54:48	1	0.1	25.26
3	08.12.2003	11:55:08	1	0.1	25.26
4	08.12.2003	11:55:27	1	0.009	13.39
5	08.12.2003	11:55:27	1	0.009	13.39
6	08.12.2003	11:55:48	1	0.009	13.39
7	08.12.2003	11:56:08	1	0.007	13.39
8	08.12.2003	11:56:28	1	0.009	13.39
9	08.12.2003	11:56:48	1	0.009	13.39
10	08.12.2003	11:56:58	1	0.009	13.39
11	08.12.2003	11:57:18	1	0.007	13.39

**Figure 11.32: Display analysis option
FFT- [Events]**

At the bottom the calculation-start level for the duration of the events is displayed. You can change this start level by using the “Event calculation”-option, see “Eve cal” at page 245).

The entries in the list can be sorted according to a given field by selecting the field at the top of the table (No., Date, Time, Phase, Extrema, Length).

The events can be paged through by using the arrow keys (see page 249).

You can also reduce the displayed events by using the filter-function, see page 244.

CBEMA

This option displays a comparison between the power events that have occurred and those of the curve named CBEMA-curve:

The „Computer and Business Equipment Manufacturers Association“ (CBEMA) specified on the basis of the AC voltage deviation tolerance level in which computers and office machines should still perform their functions without malfunctions (area marked in gray in Figure 11.33: Display analysis option 50160- [CBEMA]

Generally this curve is designed for 120 V r.m.s. and 60 Hz and the user has to estimate for himself, if this curve is also valid in his measuring case.

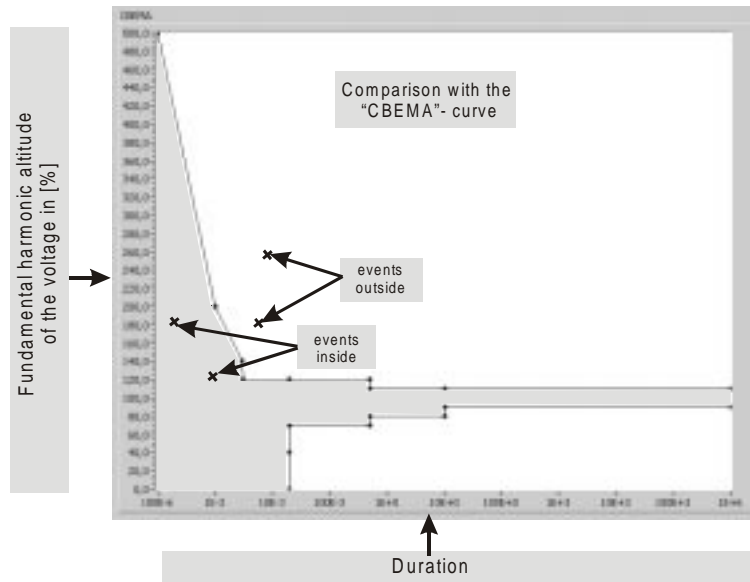


Figure 11.33: Display analysis option
50160- [CBEMA]

After pressing the button [RVC Eval], a display with a statistical evaluation of RVCs according to IEC 61000-3-7 is shown. The following picture appears:

EN50160 RVCH Events					RVC Eval
Rapid Voltage Changes					Table 1
dmax (% U _n)	Changes per hour [p.p.h.]	Hours Above Lim./H.	Percentile OK		Table 2
3.8 < dmax	r < 9	OK OK OK	100.0 100.0 100.0	1.1 1.2 1.3	794
2.5 < dmax <= 3.8	r <= 3	OK OK OK	100.0 100.0 100.0	1.1 1.2 1.3	
1.5 < dmax <= 2.5	r <= 18	OK OK OK	100.0 100.0 100.0	1.1 1.2 1.3	
1.0 < dmax <= 1.5	r <= 180	OK OK OK	100.0 100.0 100.0	1.1 1.2 1.3	
dmax <= 1.0	r <= 1800	OK OK OK	100.0 100.0 100.0	1.1 1.2 1.3	
					Report
					Print
					Exit

**Figure 11.34: Display analysis option
50160- [RVC Eval]; Table1**

On this display you can see an automatic evaluation of RVCs according to IEC 61000-3-7. The PNA collects all occurring RVCs every hour and evaluates them afterwards.

Table 2:

Every hour all RVCs are evaluated according to the limits, described in the columns "dmax" and "changes per hour".

The column "Hours" shows the amount of evaluated hours, in which the RVCs were inside the limits ("OK") and the number of evaluated hours, in which the RVCs exceeded the limits ("Above Lim.>").

The column "percentil" shows the percentage of the evaluated hours, in which the RVCs were inside the limits ("OK").

Table1:

In addition to the information described for the upper table, the evaluation display classifies the informations in several dmax-value-parts.

This option shows a list of all RVCs , which have occurred, listed with sequential numbering, date, time, dmax, dc, duration of the RVC and the phase in which the RVC occurred.

No.	Date	Time	Phase	dmax	dc	Duration
1	2012-01-01	12:00	1	1.0	0.0	0.0
2	2012-01-01	12:01	1	1.0	0.0	0.0
3	2012-01-01	12:02	1	1.0	0.0	0.0
4	2012-01-01	12:03	1	1.0	0.0	0.0
5	2012-01-01	12:04	1	1.0	0.0	0.0
6	2012-01-01	12:05	1	1.0	0.0	0.0
7	2012-01-01	12:06	1	1.0	0.0	0.0
8	2012-01-01	12:07	1	1.0	0.0	0.0
9	2012-01-01	12:08	1	1.0	0.0	0.0
10	2012-01-01	12:09	1	1.0	0.0	0.0
11	2012-01-01	12:10	1	1.0	0.0	0.0
12	2012-01-01	12:11	1	1.0	0.0	0.0
13	2012-01-01	12:12	1	1.0	0.0	0.0
14	2012-01-01	12:13	1	1.0	0.0	0.0
15	2012-01-01	12:14	1	1.0	0.0	0.0
16	2012-01-01	12:15	1	1.0	0.0	0.0
17	2012-01-01	12:16	1	1.0	0.0	0.0
18	2012-01-01	12:17	1	1.0	0.0	0.0
19	2012-01-01	12:18	1	1.0	0.0	0.0
20	2012-01-01	12:19	1	1.0	0.0	0.0
21	2012-01-01	12:20	1	1.0	0.0	0.0
22	2012-01-01	12:21	1	1.0	0.0	0.0
23	2012-01-01	12:22	1	1.0	0.0	0.0
24	2012-01-01	12:23	1	1.0	0.0	0.0
25	2012-01-01	12:24	1	1.0	0.0	0.0
26	2012-01-01	12:25	1	1.0	0.0	0.0
27	2012-01-01	12:26	1	1.0	0.0	0.0
28	2012-01-01	12:27	1	1.0	0.0	0.0
29	2012-01-01	12:28	1	1.0	0.0	0.0
30	2012-01-01	12:29	1	1.0	0.0	0.0
31	2012-01-01	12:30	1	1.0	0.0	0.0
32	2012-01-01	12:31	1	1.0	0.0	0.0
33	2012-01-01	12:32	1	1.0	0.0	0.0
34	2012-01-01	12:33	1	1.0	0.0	0.0
35	2012-01-01	12:34	1	1.0	0.0	0.0
36	2012-01-01	12:35	1	1.0	0.0	0.0
37	2012-01-01	12:36	1	1.0	0.0	0.0
38	2012-01-01	12:37	1	1.0	0.0	0.0
39	2012-01-01	12:38	1	1.0	0.0	0.0
40	2012-01-01	12:39	1	1.0	0.0	0.0
41	2012-01-01	12:40	1	1.0	0.0	0.0
42	2012-01-01	12:41	1	1.0	0.0	0.0
43	2012-01-01	12:42	1	1.0	0.0	0.0
44	2012-01-01	12:43	1	1.0	0.0	0.0
45	2012-01-01	12:44	1	1.0	0.0	0.0
46	2012-01-01	12:45	1	1.0	0.0	0.0
47	2012-01-01	12:46	1	1.0	0.0	0.0
48	2012-01-01	12:47	1	1.0	0.0	0.0
49	2012-01-01	12:48	1	1.0	0.0	0.0
50	2012-01-01	12:49	1	1.0	0.0	0.0
51	2012-01-01	12:50	1	1.0	0.0	0.0
52	2012-01-01	12:51	1	1.0	0.0	0.0
53	2012-01-01	12:52	1	1.0	0.0	0.0
54	2012-01-01	12:53	1	1.0	0.0	0.0
55	2012-01-01	12:54	1	1.0	0.0	0.0
56	2012-01-01	12:55	1	1.0	0.0	0.0
57	2012-01-01	12:56	1	1.0	0.0	0.0
58	2012-01-01	12:57	1	1.0	0.0	0.0
59	2012-01-01	12:58	1	1.0	0.0	0.0
60	2012-01-01	12:59	1	1.0	0.0	0.0
61	2012-01-01	13:00	1	1.0	0.0	0.0
62	2012-01-01	13:01	1	1.0	0.0	0.0
63	2012-01-01	13:02	1	1.0	0.0	0.0
64	2012-01-01	13:03	1	1.0	0.0	0.0
65	2012-01-01	13:04	1	1.0	0.0	0.0
66	2012-01-01	13:05	1	1.0	0.0	0.0
67	2012-01-01	13:06	1	1.0	0.0	0.0
68	2012-01-01	13:07	1	1.0	0.0	0.0
69	2012-01-01	13:08	1	1.0	0.0	0.0
70	2012-01-01	13:09	1	1.0	0.0	0.0
71	2012-01-01	13:10	1	1.0	0.0	0.0
72	2012-01-01	13:11	1	1.0	0.0	0.0
73	2012-01-01	13:12	1	1.0	0.0	0.0
74	2012-01-01	13:13	1	1.0	0.0	0.0
75	2012-01-01	13:14	1	1.0	0.0	0.0
76	2012-01-01	13:15	1	1.0	0.0	0.0
77	2012-01-01	13:16	1	1.0	0.0	0.0
78	2012-01-01	13:17	1	1.0	0.0	0.0
79	2012-01-01	13:18	1	1.0	0.0	0.0
80	2012-01-01	13:19	1	1.0	0.0	0.0
81	2012-01-01	13:20	1	1.0	0.0	0.0
82	2012-01-01	13:21	1	1.0	0.0	0.0
83	2012-01-01	13:22	1	1.0	0.0	0.0
84	2012-01-01	13:23	1	1.0	0.0	0.0
85	2012-01-01	13:24	1	1.0	0.0	0.0
86	2012-01-01	13:25	1	1.0	0.0	0.0
87	2012-01-01	13:26	1	1.0	0.0	0.0
88	2012-01-01	13:27	1	1.0	0.0	0.0
89	2012-01-01	13:28	1	1.0	0.0	0.0
90	2012-01-01	13:29	1	1.0	0.0	0.0
91	2012-01-01	13:30	1	1.0	0.0	0.0
92	2012-01-01	13:31	1	1.0	0.0	0.0
93	2012-01-01	13:32	1	1.0	0.0	0.0
94	2012-01-01	13:33	1	1.0	0.0	0.0
95	2012-01-01	13:34	1	1.0	0.0	0.0
96	2012-01-01	13:35	1	1.0	0.0	0.0
97	2012-01-01	13:36	1	1.0	0.0	0.0
98	2012-01-01	13:37	1	1.0	0.0	0.0
99	2012-01-01	13:38	1	1.0	0.0	0.0
100	2012-01-01	13:39	1	1.0	0.0	0.0

Figure 11.35: Display analysis option
50160- [RVC List]

The entries in the list can be sorted according to a given field by selecting the field at the top of the table (No., Date, Time, Phase, dmax, dc, duration).

The events can be paged through by using the arrow keys (see page 249).



You can also reduce the displayed events by using the filter-function, see page 244.

RVC Table

This option shows all stored RVCs, sorted in a table with different dc- (or dmax-) values and durations.

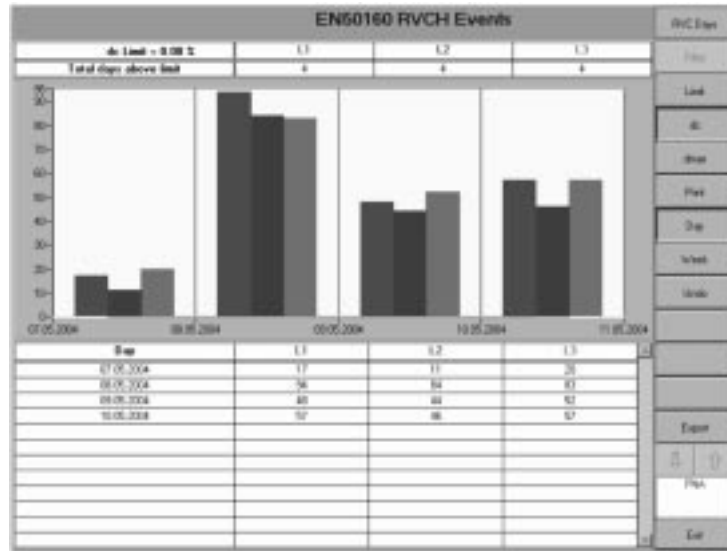
[illegible]

Figure 11.36: Display analysis option
50160- [*RVC Table*]

Depending if you have selected **dc** (, default) or **dmax** () their range-classification are defined in the first column and ranges for the duration of the RVCs at the top of each column.

You can change the sorting fields for duration, but also the sorting fields for the dc/dmax-classes by using the “Table Limits.”-option, see page 246.

This option shows a daily/weekly statistic of the stored RVCs, as demanded in EN50160.



**Figure 11.37: Display analysis option
50160- [RVC Days]**

Depending if you have selected **dc** (, default) or **dmax** () and if you have selected **Day** (, default) or **Week** () , the display shows an appropriate statistical evaluation of all stored RVCs.

Just select for example **dc** and **Day** to show you all RVCs of the whole measurement, sorted by phases and the day of occurrence.

If you want to see only RVCs, whose dc-values are higher than a user-definable threshold, click on the - button and enter a threshold level in the following sub-window:

The 'Define RVCH Limits' dialog box has two input fields: 'dc Limit [%]' with a value of 0.00 and 'dmax Limit [%]' with a value of 0.00. There are 'Cancel' and 'OK' buttons at the bottom.

With this button, all threshold settings for a power quality analysis can be selected. The button **[Set To Default]** resets all threshold definitions to values according to EN 50160. The following input window appears:

The 'Def. Limits' dialog box contains the following settings:

- Voltage:** Low Limit: 90.0 [%], High Limit: 110.0 [%]
- Frequency:** Low Limit: 49.5 [Hz], High Limit: 50.5 [Hz]
- THD:** Low Limit: 0.0 [%], High Limit: 5.0 [%]
- Unbalance:** Low Limit: 0.0 [%], High Limit: 1.0 [%]
- Percent:** Low Limit: 0.0 [%], High Limit: 1.0 [%]
- Frequency:** Low Limit: 49.5 [Hz], High Limit: 50.5 [Hz]
- Harmonics:**
 - Harmonic 2: 2.00
 - Harmonic 3: 1.00
 - Harmonic 4: 1.00
 - Harmonic 5: 0.50
 - Harmonic 6: 0.50
 - Harmonic 7: 0.50
 - Harmonic 8: 0.50
 - Harmonic 9: 1.50
 - Harmonic 10: 0.50
 - Harmonic 11: 0.50
 - Harmonic 12: 0.50
 - Harmonic 13: 0.50
 - Harmonic 14: 0.50
 - Harmonic 15: 0.50
 - Harmonic 16: 0.50
 - Harmonic 17: 2.00
 - Harmonic 18: 0.50
 - Harmonic 19: 1.00
 - Harmonic 20: 0.50
 - Harmonic 21: 0.50
 - Harmonic 22: 0.50
 - Harmonic 23: 1.00
 - Harmonic 24: 0.50
 - Harmonic 25: 1.00
- Buttons:** Set To Default, Cancel, OK

For events (event list, CBEMA) and RVC (RVC List) display you can use the filter function to reduce the displayed events/RVCs:


The 'Event Filter' dialog box contains the following settings:

- Start Time:** 11/10/2008 10:00
- Stop Time:** 11/10/2008 11:00
- Phases:** 1, 2, 3
- Duration:** Min: 0.0, Max: 0.0
- Buttons:** Filter, Cancel, OK

For events evaluation the events, which are shown in the event list or in the CBEMA curve, can be reduced (filtered). Filter criteria are measurement time, phases, extreme values (residual voltages) and event duration.



For RVC evaluation the events, which are shown in the RVC list, can be reduced (filtered). Filter criteria are measurement time, phases, dmax, dc and RVC duration.

If the filter-function is activated the button lights red ().

With the “Event calculation”-function you can change the calculation of the duration of the events:



Normally the event starts at 90% U_N crossing. If you want to know the duration of the event from another starting point on, just choose another crossing level from the list-field “Calculation start level”. This function can be used in the analysis option 50160- [Event Table] and 50160- [Event List].

For the analysis option 50160- [Event Table] you can also change the duration ranges of the table by changing the range-limits in the white fields of the lower area (“Event Table Bin Ranges [s]”).

With the “Table Limits”-function you can change the limits of the sorting fields of the RVC table.



For the analysis option 50160- [RVC Table] you can change the duration ranges of the table by changing the range-limits in the white fields (“RVCH Table Bin Ranges [s]”). The limits for the sorting fields for the dc-value can be set by entering the desired values in the white fields of “RVCH Table dc ranges”.

For a precise description, see section 11.3.1.2.2, page 206.
In the analysis option „50160“, the print-out appears as follows:

CHAUVIN ARNOUX **EN50160-Protokoll**

Report:
Messstation: 17 2003 1700 00 0000 00
Messgerät: Fluke
Messmethode: EN 50160:2002 41 50 00
Start der Messung: 17.12.2002 09:40:00
Ende der Messung: 17.12.2002 09:40:00
Messungsdauer: 00:00:00

Strom (Grundlast) Strom (Grundlast + Messung)

	Phase I RMS dB	Phase I max dB	Phase I RMS dB	Phase I max dB	Phase I RMS dB	Phase I max dB	Summe dB	Intermitt. Anzahl
1	120	120	120	120	120	120	120	0
2	120	120	120	120	120	120	120	0
3	120	120	120	120	120	120	120	0
4	120	120	120	120	120	120	120	0
5	120	120	120	120	120	120	120	0
6	120	120	120	120	120	120	120	0
7	120	120	120	120	120	120	120	0
8	120	120	120	120	120	120	120	0
9	120	120	120	120	120	120	120	0
10	120	120	120	120	120	120	120	0
11	120	120	120	120	120	120	120	0
12	120	120	120	120	120	120	120	0
13	120	120	120	120	120	120	120	0
14	120	120	120	120	120	120	120	0
15	120	120	120	120	120	120	120	0
16	120	120	120	120	120	120	120	0
17	120	120	120	120	120	120	120	0
18	120	120	120	120	120	120	120	0
19	120	120	120	120	120	120	120	0
20	120	120	120	120	120	120	120	0
21	120	120	120	120	120	120	120	0
22	120	120	120	120	120	120	120	0
23	120	120	120	120	120	120	120	0
24	120	120	120	120	120	120	120	0
25	120	120	120	120	120	120	120	0
26	120	120	120	120	120	120	120	0
27	120	120	120	120	120	120	120	0
28	120	120	120	120	120	120	120	0
29	120	120	120	120	120	120	120	0
30	120	120	120	120	120	120	120	0

Edison Unverschleiß

**Figure 11.38: Protocol 1
analysis option
[50160-Tota]**

CHAUVIN ARNOUX **EN50160-Protokoll**

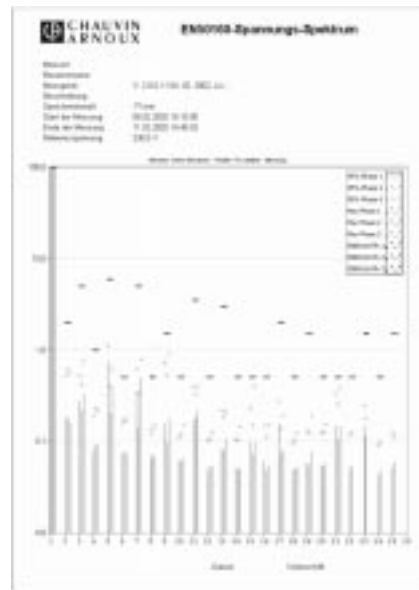
Report:
Messstation: 17 2003 1700 00 0000 00
Messgerät: Fluke
Messmethode: EN 50160:2002 41 50 00
Start der Messung: 17.12.2002 09:40:00
Ende der Messung: 17.12.2002 09:40:00
Messungsdauer: 00:00:00

Strom (Grundlast) Strom (Grundlast + Messung)

	Phase I RMS dB	Phase I max dB	Phase I RMS dB	Phase I max dB	Phase I RMS dB	Phase I max dB	Summe dB	Intermitt. Anzahl
1	120	120	120	120	120	120	120	0
2	120	120	120	120	120	120	120	0
3	120	120	120	120	120	120	120	0
4	120	120	120	120	120	120	120	0
5	120	120	120	120	120	120	120	0
6	120	120	120	120	120	120	120	0
7	120	120	120	120	120	120	120	0
8	120	120	120	120	120	120	120	0
9	120	120	120	120	120	120	120	0
10	120	120	120	120	120	120	120	0
11	120	120	120	120	120	120	120	0
12	120	120	120	120	120	120	120	0
13	120	120	120	120	120	120	120	0
14	120	120	120	120	120	120	120	0
15	120	120	120	120	120	120	120	0
16	120	120	120	120	120	120	120	0
17	120	120	120	120	120	120	120	0
18	120	120	120	120	120	120	120	0
19	120	120	120	120	120	120	120	0
20	120	120	120	120	120	120	120	0
21	120	120	120	120	120	120	120	0
22	120	120	120	120	120	120	120	0
23	120	120	120	120	120	120	120	0
24	120	120	120	120	120	120	120	0
25	120	120	120	120	120	120	120	0
26	120	120	120	120	120	120	120	0
27	120	120	120	120	120	120	120	0
28	120	120	120	120	120	120	120	0
29	120	120	120	120	120	120	120	0
30	120	120	120	120	120	120	120	0

Edison Unverschleiß

**Figure 11.39: Protocol 2
analysis option
[50160-Tota]**



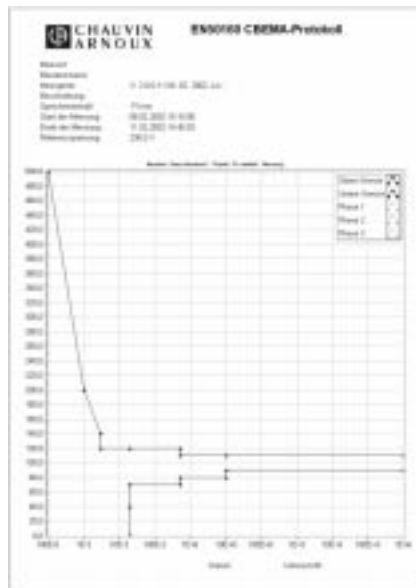


Figure 11.42:
Protocol
analysis option
50160-CBEMA]

Export

By pressing this button, the list of power events is exported in a "...txt." file. The new file ("...txt") is saved to the folder „...\Data2_EXPORT“.

1

2

3

With these buttons, it is possible to switch on/off individual inputs to the graphs (e.g. phase values). Only activated inputs to the graph are represented.

Input 1 = red; Input 2 = blue; Input 3 = green



These arrow keys can be used to page through the events in the event list or in the "CBEMA" curve.

Exit

This button terminates the analysis option [50160] and returns the user to the start-screen of the program "C.A 8352-Post" (see section 11.2).

Transient R.

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[illegible]






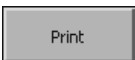
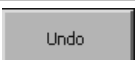
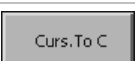

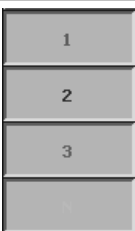

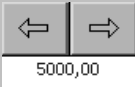

Figure 11.43: Start screen within the analysis option [Transient R.]

11.3.5.1 Main display area

The display of the analysis option [*Transient R.*] always begins with a summary of the recorded (transient) events in chronological order. This listing also includes the event criteria which led to recognizing the event and the phase in which the event has happened.

11.3.5.2 Right button panel: menu buttons and their functions

11.3.5.2.1 Overview

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		... Page 261
		... Page 261

⁴⁷ Drop-down menu by pressing the button

11.3.5.2.2 Detail



By pressing this button, the user is provided with a summary of the recorded (transient) events in chronological order. This listing also includes the event criteria which led to recognizing the event and the phase in which the event has happened. In this area, one or two events can be marked in order to view their time dependence (see option [*x(t) Graph*], page 253) or their spectrum (see option [*Spectra*], page 257).

Description of the displayed measurement

event 2
(not marked)

event 3
(marked)

No.	Date	Time	Phase	Condition
1	2012-03-05	08:00:00	1	0.0000
2	2012-03-05	08:00:01	1.1.1	0.0000
3	2012-03-05	08:00:02	1.1.1	0.0000
4	2012-03-05	08:00:03	1.1.1	0.0000
5	2012-03-05	08:00:04	1.1.1	0.0000
6	2012-03-05	08:00:05	1.1.1	0.0000
7	2012-03-05	08:00:06	1.1.1	0.0000
8	2012-03-05	08:00:07	1.1.1	0.0000
9	2012-03-05	08:00:08	1.1.1	0.0000
10	2012-03-05	08:00:09	1.1.1	0.0000

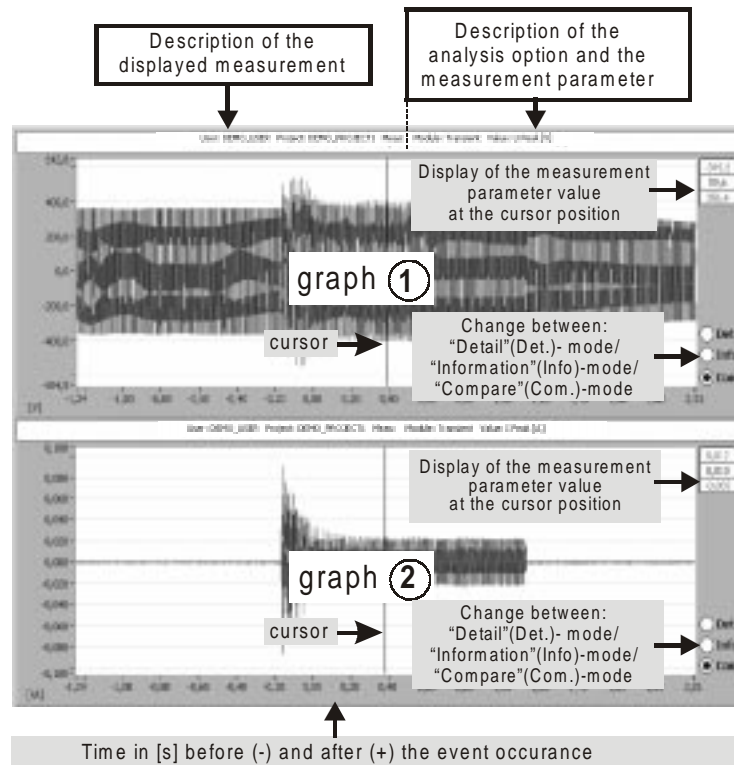
Figure 11.45: Display analysis option
Transient R.- [*Table*]



This button brings the user to a display of the time dependences of different recorded measurement parameters of the marked event(s).

- **Display in "Compare" mode ("Com")**

This mode is activated when the field „**Com.**“ is activated in both graphs (see Figure 11.46: Display analysis option Transient R.- [*x(t) Graph*] in „Compare“- mode).



**Figure 11.46: Display analysis option
Transient R.- $[x(t)$ Graph] in „Compare“- mode**

In this mode, in graphs 1 and 2 **the time dependence of two different parameters of one measurement or the time dependence of one parameter of two separate measurements** (selection of two measurements, see page 253) can be displayed and compared.

Zoom function:

Through the "**Zoom**" mechanism (touchscreen: touch the screen at a desired position on the screen with the pen, move it to the desired final position and take the pen off the screen again; mouse: click on a position with the left mouse button and drag the cursor to the desired position and release the mouse button again) individual time ranges **in the area of a graph** can be zoomed out. This zoom function affects the other graph at the same time.

(To reset the zoom function, see page 260)

Moving the cursor: see page 261

Changing the scaling of the y-axis: see page 201

- **Display in „Information“ mode („Info“)**

This mode is activated when the field „Info“ is activated in one of the two graphs (see Figure 11.47: Display analysis option Transient R.- $[x(t)$ Graph] in „Information“ mode).

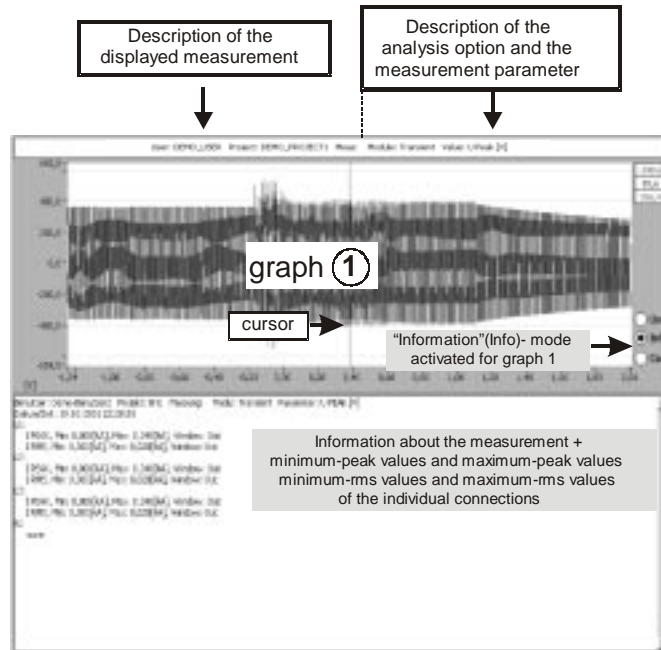


Figure 11.47: Display analysis option Transient R.- $[x(t)$ Graph] in „Information“ mode

In this mode, certain measurement parameter values (minimum and maximum r.m.s. and peak values over the entire measurement period) of one of the two graphs can be displayed in a brief overview.

- **Display in „Detail“ mode („Det.“)**

This mode is activated when the field „Det.“ is activated in one of the two graphs (see Figure 11.48: Display analysis option

Transient R.- $[x(t)Graph]$ in „Detail“ mode

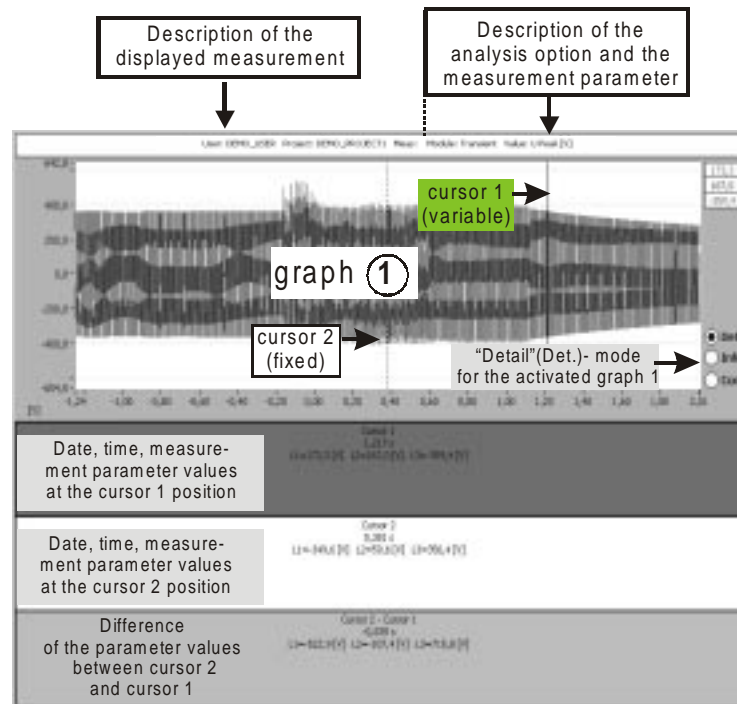


Figure 11.48: Display analysis option Transient R.- $[x(t)Graph]$ in „Detail“ mode

In this mode, **the time dependence of a measurement parameter** can be analyzed in detail in one of the two graphs by using one of the two cursors.

Moving the (variable) cursor: see page 261

An individual area can also be “zoomed” in this mode and the scaling of the y-axis can be changed (see section 11.3.1.1.1).

In this option, the selected events are subjected to a frequency analysis.

- **Display in "Compare" mode ("Com.")**

This mode is activated when the field "**Com.**" is activated in both graphs (see Fig.11.49 Display analysis option Transient R.- [Spectra] in „Compare“ mode.

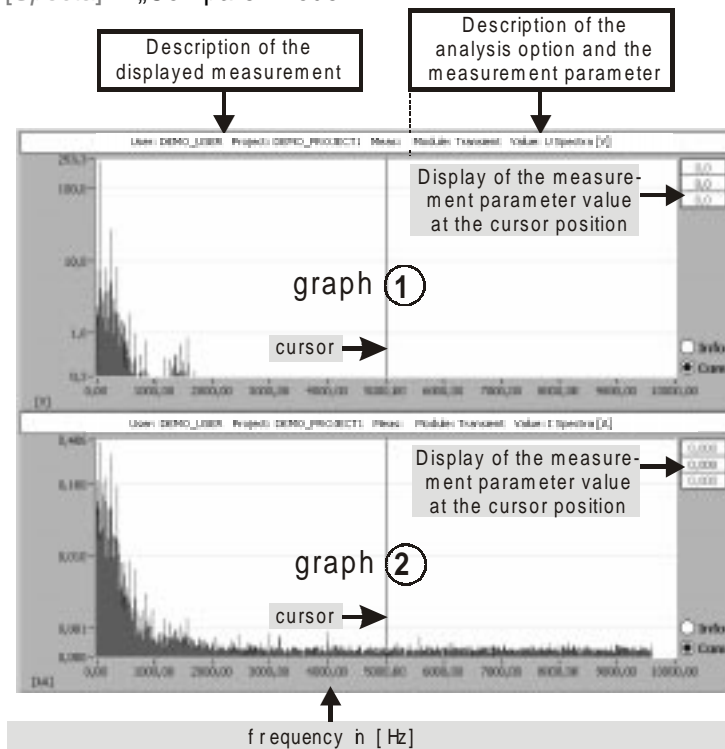


Figure 11.49: Display analysis option Transient R.- [Spectra] in „Compare“ mode

In this mode, in graphs 1 and 2 the frequency spectra of two different measurement parameters of one event or the frequency spectra of one measurement parameter of two separate events can be displayed and compared with each other.

Zoom function:

Through the "**Zoom**" mechanism (touchscreen: touch the screen at a desired position on the screen with the pen, move it to the desired final position and take the pen off the screen again; mouse: click on a position with the left mouse button and drag the cursor to the desired position and release the mouse button again) individual frequency ranges **in the area of a graph** can be zoomed out. This zoom function affects the other graph at the same time.

- **Display in "Information" mode ("Info")**

This mode is activated when the field "**Info**" is activated in one of the two graphs.

In this mode, certain measurement parameter values (minimum and maximum r.m.s. and peak values over the entire measurement period) of one of the two graphs can be displayed in a brief overview.

Filter

With this button, the events, which are displayed in the event list (Table), can be reduced (filtered). Filter criteria are measurement time, phases, and event criteria.



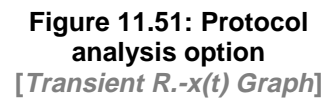
Value In Gr.

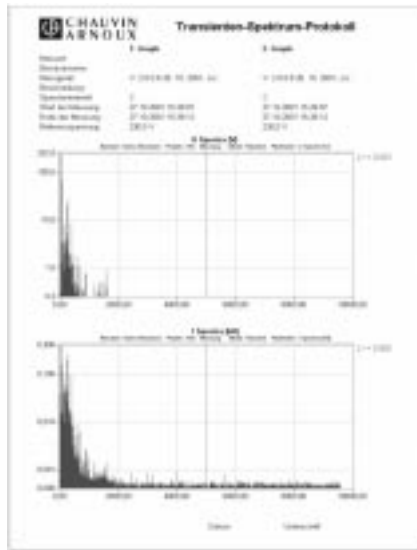
By pressing this button, different measurement parameters can be selected whose time dependence and/or spectrographic analysis are to be displayed. One of the following selection windows opens:



In the analysis option „Transient R.“, the print-out appears as follows:

Figure 11.50: Protocol analysis option
[*Transient R.-Table*]





**Figure 11.52: Protocol
analysis option
[Transient R.-Spectra]**

Undo

By pressing this button, the displays in both graphs are reset to the display of the entire event.

Curs.To C

This button resets the cursor to the center of the display in both graphs.

Export

By pressing this button, the list of transient events is exported in a „...txt.“-file. The new file („...txt“) is saved to the folder „...\\Data2_EXPORT“.

1

2

3

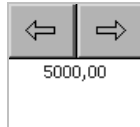
With these buttons, it is possible to switch on/off individual inputs to the graphs (e.g. phase values). Only activated inputs to the graph are represented.

Input 1 = red
Input 2 = blue

Input 3 = green
Input N = yellow



With these arrow keys, the event list (Table) can be paged through.



With these arrow keys, the cursor is moved simultaneously in both graphs.

In the display area below, the current cursor position is shown as a time (x(t)-graph) and/or as a frequency (spectra)



This button terminates the analysis option [*Transient R.*] and returns the user to the start-screen of the program "C.A 8352-Post" (see section 11.2).

Telegramms

Telegrams:

Tubulin

Figure 11.53: Start screen within the analysis option [Telegrams]

11.3.6.1 Main display area

Description of the displayed measurement

alarm 1
(unmarked)

alarm 2-5
(marked)

No.	Date	Time	Phase	Check Sum
1.	11.12.2001	15:21:40	-1	0000021960
2.	11.12.2001	15:21:40	-2	0000021960
3.	11.12.2001	15:21:40	-3	0000021960
4.	11.12.2001	16:30:16	-1	0000020398
5.	11.12.2001	16:30:16	-2	0000020398
6.	11.12.2001	16:30:16	-3	0000020398
7.	11.12.2001	16:39:48	-1	0000017658
8.	11.12.2001	16:39:48	-2	0000017658
9.	11.12.2001	16:39:48	-3	0000020766
10.	11.12.2001	16:10:52	-1	0000010900
11.	11.12.2001	16:10:52	-2	0000022680
12.	11.12.2001	16:10:52	-3	0000024644
13.	11.12.2001	16:12:32	-1	0000024608
14.	11.12.2001	16:12:32	-2	0000024482
15.	11.12.2001	16:12:32	-3	0000024482
16.	11.12.2001	16:15:07	-1	0000020750
17.	11.12.2001	16:15:07	-2	0000023608
18.	11.12.2001	16:15:07	-3	0000023730
19.	11.12.2001	16:17:16	-1	0000020520
20.	11.12.2001	16:17:16	-2	0000020520
21.	11.12.2001	16:17:16	-3	0000022008
22.	11.12.2001	16:18:16	-1	0000020882
23.	11.12.2001	16:18:16	-2	0000024246
24.	11.12.2001	16:18:16	-3	0000022492
25.	11.12.2001	22:31:19	-1	0000016586

Figure 11.54: Start screen within the analysis option [Telegrams]; overview




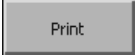
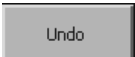
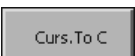



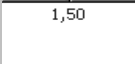

Right button panel:

On the right hand side of the screen one finds the **action-panel** (overview of the buttons and their functions: Page 264) for switching to different data analysis functions and other menu buttons available within the analysis option [Telegrams].




11.3.6.2 Right button panel: menu buttons and their functions

11.3.6.2.1 Overview

	⁴⁸	... Page 264
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		... Page 268
		... Page 268
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		... Page 268
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11.3.6.2.2 Detail

	By pressing this button, the user is provided with a summary of the recorded telegrams in chronological order. This listing also includes the phase in which the telegram was detected and a brief description of the telegram ("Checksum": special coding for rapid identification). One or more telegrams can be marked in this area in order to view their time dependence (see option [<i>x(t)-Graph</i>], page 265).
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⁴⁸ Drop-down menu by pressing the button

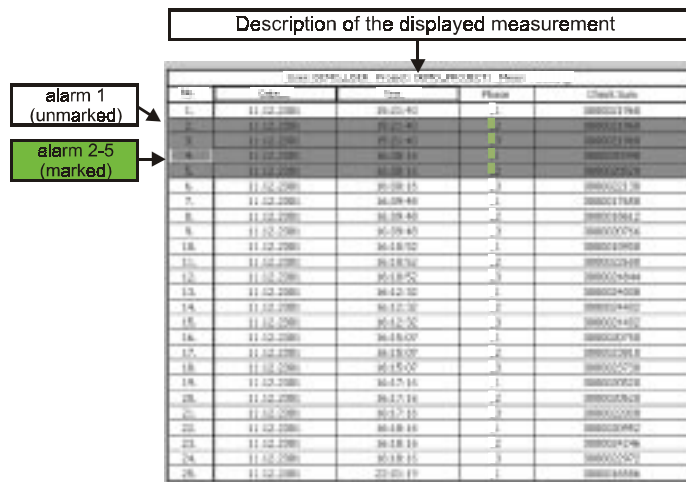


Figure 11.55: Display analysis option
Alarms- [Table]

x(t) Graph

This button takes the user to a display of the time dependence (in seconds) of the selected telegrams:

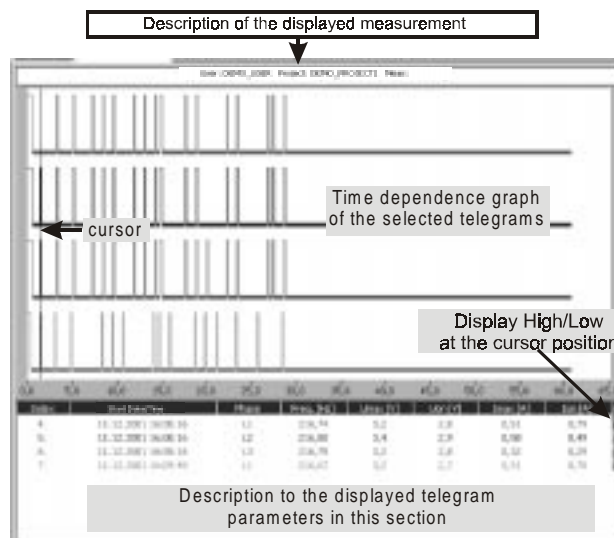


Figure 11.56: Display analysis option
Telegrams- [x(t) Graph]

- **Freq:** Indicates the exact measured frequency for the captured telegram.

- **Umax:** Indicates the maximum voltage level (r.m.s. value) of the telegram signal, which arose during the captured telegram.

- **Imax:** Indicates the maximum current level (r.m.s. value) of the telegram signal, which arose during the captured telegram.

- **Uon:** Indicates the average voltage level (r.m.s. value) of the single logical 1-signal (high condition) over the captured telegram packet (total length) for which the value lies above the response threshold.

- **Ion:** As for current.

Zoom function:

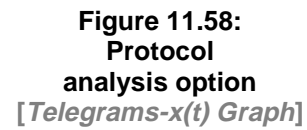
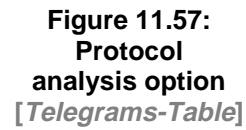
Through the "**Zoom**" mechanism (touchscreen: touch the screen at a desired position on the screen with the pen, move it to the desired final position and take the pen off the screen again; mouse: click on a position with the left mouse button and drag the cursor to the desired position and release the mouse button again) individual areas **in the area of a telegram time dependence** can be zoomed out. This zoom function affects the other graph at the same time.

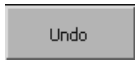
Filter

With this button, the telegrams, which are shown in the telegram list (Table), can be reduced (filtered). Filter criteria are measurement time, phases, telegram conditions.

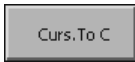
The image shows a 'Telegram Filter' dialog box. It has two time input fields: 'Start Time' and 'Stop Time', both set to '02/12/2002 9:07'. Below these is a horizontal slider bar. Under the slider, there are labels 'Start 02/12/2002' and 'Stop 02/12/2002'. Below the slider is a 'Phases' section with three radio buttons labeled '1', '2', and '3'. Below that is a 'Condition' section with 'Min' and 'Max' input fields. 'Min' is set to '1' and 'Max' is set to '4096/120'. At the bottom of the dialog are three buttons: 'Read', 'Cancel', and 'OK'.

In the analysis option „Telegrams“, the print-out appears as follows:





By pressing this button, the display of the time dependence is reset to display the total telegram duration.



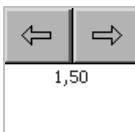
This button resets the cursor to the center of the display.



By pressing this button, the list of telegrams is exported in a „...txt.“ file (saved in tabular form in a text file). The new file („...txt“) is saved to the folder „...\\Data2_EXPORT“ and can be opened and/or processed from here.

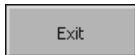


These arrow keys can be used to page through the list of telegrams (Table).



With these arrow keys, the cursor can be moved through the telegram duration graph.

The current cursor position in seconds of the telegram duration is indicated in the display area underneath.



With this button, the analysis option [*Telegrams*] terminates and the user is returned to the start-screen of the program "C.A 8352-Post" (see section 11.2).



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